



## Subject Category Descriptions Catalog

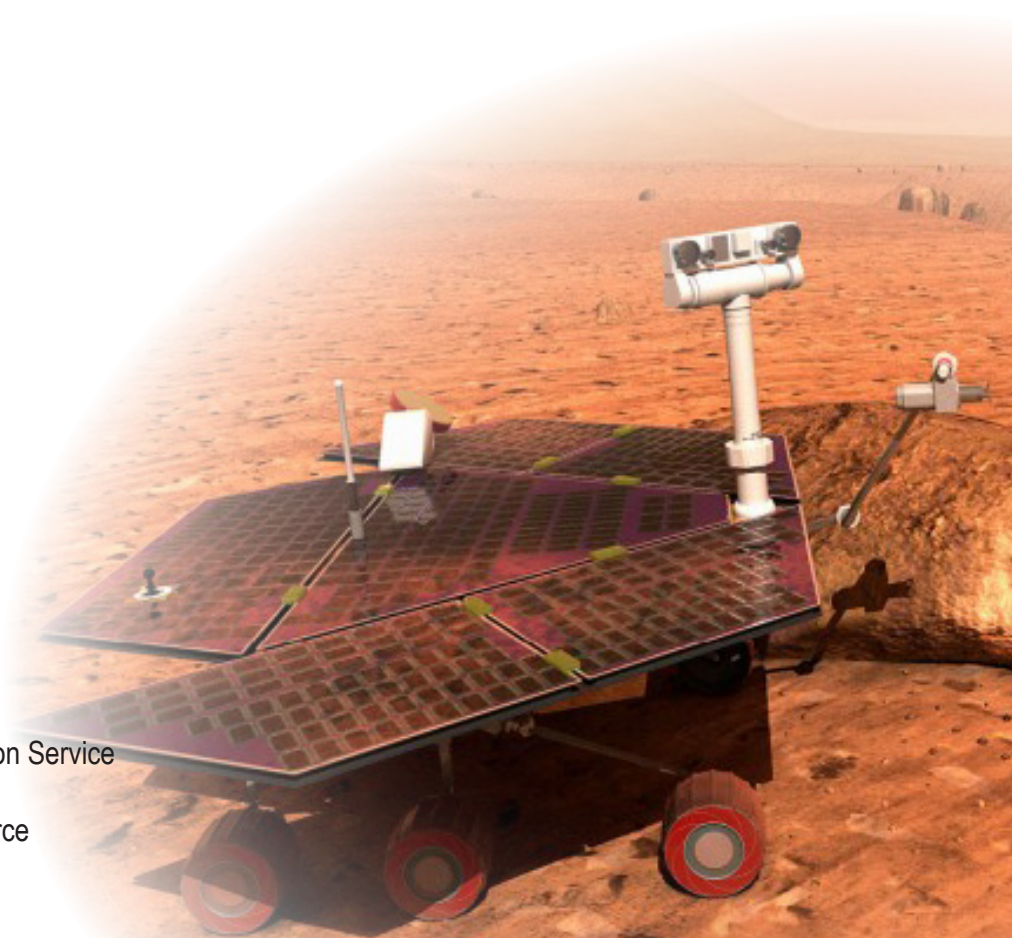
# S&T on CD

Science and  
Technology  
on CD

**SRS**  
Selected Research  
Service



National Technical Information Service  
Technology Administration  
U.S. Department of Commerce  
5301 Shawnee Rd,  
Alexandria, VA 22312



## NTIS SUBJECT OPTIONS

Use these specific subjects to select the R&D and engineering results you wish and then fill out the order form at the end of this guide.

The subject options are arranged within 39 broad subject categories. Each of these categories is further divided into specific subcategories. Selection of technical reports can be made either by a specific subcategory or by complete categories. Subject Category descriptions are listed beginning on page 14.

Approximate number of reports issued in a given year is listed under the column *SRS and S & T Title Counts*. When ordering, you will need these estimates to complete the order form and estimate your annual cost. Forms are located on the final page of this document.

\* The number of reports estimated for an overall category will be less than the total of its subcategories. Reports which have been coded for more than one subcategory are only counted once in the total estimate.

### SUBJECT CATEGORIES DESCRIPTION TABLE

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>ADMINISTRATION &amp; MANAGEMENT</b>		<b>70</b>		<b>5025</b>
	General	700	218	
	Inventory Control	70A	4	
	Management Practice	70B	1886	
	Management Information Systems	70C	109	
	Personnel Management, Labor Relations & Manpower Studies	70D	921	
	Research Program Administration & Technology Transfer	70E	168	
	Public Administration & Government	70F	3058	
	Productivity	70G	49	
<b>AERONAUTICS &amp; AERODYNAMICS</b>		<b>51</b>		<b>838</b>
	General	510	27	
	Aerodynamics	51A	171	
	Aeronautics	51B	134	
	Aircraft	51C	498	
	Parachutes & Decelerators	51D	11	
	Avionics	51E	55	
	Test Facilities & Equipment	51F	86	
<b>AGRICULTURE &amp; FOOD</b>		<b>98</b>		<b>1852</b>
	General	980	156	
	Agricultural Chemistry	98A	17	
	Agricultural Economics	98B	865	
	Agricultural Equipment, Facilities, & Operations	98C	130	
	Agronomy, Horticulture, & Plant Pathology	98D	113	
	Animal Husbandry & Veterinary Medicine	98E	58	
	Fisheries & Aquaculture	98F	497	
	Agriculture Resource Surveys	98G	45	
	Food Technology	98H	268	

For those DOD, DOE, and NASA contractors receiving copies of technical reports directly from these agencies as part of their contract, NTIS is able to exclude these reports from your distribution.

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>ASTRONOMY &amp; ASTROPHYSICS</b>		<b>54</b>		<b>743</b>
	General	540	299	
	Astrogeology	54A	32	
	Astronomy & Celestial Mechanics	54B	186	
	Astrophysics	54C	255	
	Cosmic Ray Research	54D	8	
<b>ATMOSPHERIC SCIENCES</b>		<b>55</b>		<b>1155</b>
	General	550	106	
	Aeronomy	55A	202	
	Dynamic Meteorology	55B	46	
	Meteorological Data Collection, Analysis, & Weather Forecasting	55C	773	
	Meteorological Instruments & Instrument Platforms	55D	77	
	Physical Meteorology	55E	117	
	Weather Modification	55F	2	
<b>BEHAVIOR &amp; SOCIETY</b>		<b>92</b>		<b>4983</b>
	General	920	981	
	Job Training & Career Development	92A	546	
	Psychology	92B	507	
	Social Concerns	92C	2185	
	Education, Law, & Humanities	92D	1293	
	International Relations	92E	603	
<b>BIOMEDICAL TECHNOLOGY &amp; HUMAN FACTORS ENGINEERING</b>		<b>95</b>		<b>550</b>
	General	950	8	
	Prosthetics & Mechanical Organs	95A	14	
	Tissue Preservation & Storage	95B	9	
	Biomedical Instrumentation & Bioengineering	95C	139	
	Human Factors Engineering	95D	139	
	Life Support Systems	95E	128	
	Bionics & Artificial Intelligence	95F	50	
	Protective Equipment	95G	87	
<b>BUILDING INDUSTRY TECHNOLOGY</b>		<b>89</b>		<b>533</b>
	General	890	57	
	Architectural Design & Environmental Engineering	89B	214	
	Construction Management & Techniques	89C	43	
	Structural Analyses	89D	153	
	Building Standards & Codes	89E	24	
	Construction Materials, Components, & Equipment	89G	101	
	Building Equipment, Furnishings, & Maintenance	89H	25	

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>BUSINESS &amp; ECONOMICS</b>		<b>96</b>		<b>3587</b>
	General	960	901	
	Domestic Commerce, Marketing,& Economics	96A	1309	
	International Commerce, Marketing, & Economics	96C	1462	
	Consumer Affairs	96D	141	
	Minority Enterprises	96E	12	
	Banking & Finance	96F	593	
	Foreign Industry Economic Development	96G	78	
	Foreign Business & Economics	96H	43	
<b>CHEMISTRY</b>		<b>99</b>		<b>1908</b>
	General	990	211	
	Analytical Chemistry	99A	87	
	Industrial Chemistry & Chemical Process Engineering	99B	129	
	Polymer Chemistry	99C	68	
	Basic & Synthetic Chemistry	99D	171	
	Photochemistry & Radiation Chemistry	99E	26	
	Physical & Theoretical Chemistry	99F	398	
<b>CIVIL ENGINEERING</b>		<b>50</b>		<b>1139</b>
	General	500	75	
	Highway Engineering	50A	642	
	Civil Engineering	50B	325	
	Construction Equipment, Materials,& Supplies	50C	338	
	Soil & Rock Mechanics	50D	126	
<b>COMBUSTION, ENGINES, &amp; PROPELLANTS</b>		<b>81</b>		<b>427</b>
	General	810	8	
	Combustion & Ignition	81A	124	
	Electric & Ion Propulsion	81B	48	
	Fuel & Propellant Tanks	81C	12	
	Jet & Gas Turbine Engines	81D	87	
	Rocket Engines & Motors	81G	60	
	Rocket Propellants	81H	41	
	Nuclear Propulsion	81I	11	
	Reciprocation & Rotating Combustion Engines	81J	79	



Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>COMMUNICATION</b>		<b>45</b>		<b>706</b>
	General	450	38	
	Policies, Regulations, & Studies	45A	51	
	Radio & Television Equipment	45B	10	
	Common Carrier & Satellite	45C	596	
	Sociopolitical	45D	26	
	Graphics	45E	10	
	Verbal	45F	27	
	Communication & Information Theory	45G	5	
<b>COMPUTERS, CONTROL &amp; INFORMATION THEORY</b>		<b>62</b>		<b>1752</b>
	General	620	917	
	Computer Hardware	62A	74	
	Computer Software	62B	743	
	Control Systems & Control Theory	62C	14	
	Information Processing Standards	62D	181	
	Information Theory	62E	2	
	Pattern Recognition & Image Processing	62F	37	
<b>DETECTION &amp; COUNTERMEASURES</b>		<b>63</b>		<b>603</b>
	General	630	94	
	Acoustic Detection	63A	108	
	Electromagnetic & Acoustic Countermeasures	63B	38	
	Infrared & Ultraviolet Detection	63C	88	
	Magnetic Detection	63D	30	
	Nuclear Explosion Detection	63E	5	
	Optical Detection	63F	117	
	Personnel Detection	63G	4	
	Radiofrequency Detection	63H	133	
	Seismic Detection	63I	15	
<b>ELECTROTECHNOLOGY</b>		<b>49</b>		<b>549</b>
	General	490	334	
	Antennas	49A	27	
	Circuits	49B	34	
	Electromechanical Devices	49C	8	
	Electron Tubes	49D	1	
	Optoelectronic Devices & Systems	49E	76	
	Power & Signal Transmission Devices	49F	13	
	Resistive, Capacitive, & Inductive Components	49G	28	
	Semiconductor Devices	49H	44	

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>ENERGY</b>		<b>97</b>		<b>2284</b>
	General	970	67	
	Reserves	97A	108	
	Energy Use, Supply, & Demand	97B	403	
	Electric Power Transmission	97E	63	
	Fuel Conversion Processes	97F	39	
	Policies, Regulations & Studies	97G	595	
	Electric Power Production	97I	263	
	Heating & Cooling Systems	97J	102	
	Fuels	97K	674	
	Engine Studies Energy Related	97L	18	
	Batteries & Components	97M	96	
	Solar Energy	97N	208	
	Miscellaneous Energy Conversion & Storage	97O	359	
	Geothermal Energy	97P	30	
	Selected Studies In Nuclear Technology	97Q	64	
	Environmental Studies	97R	295	
<b>ENVIRONMENTAL POLLUTION &amp; CONTROL</b>		<b>68</b>		<b>3358</b>
	General	680	345	
	Air Pollution & Control	68A	487	
	Noise Pollution & Control	68B	69	
	Solid Wastes Pollution & Control	68C	194	
	Water Pollution & Control	68D	983	
	Pesticides Pollution & Control	68E	26	
	Radiation Pollution & Control	68F	199	
	Environmental Health & Safety	68G	1364	
	Environmental Impact Statements	68H	62	
<b>GOVERNMENT INVENTIONS FOR LICENSING</b>		<b>90</b>		<b>5</b>
	General	900	3	
	Mechanical Devices & Equipment	90A	0	
	Chemistry	90B	0	
	Nuclear Technology	90C	0	
	Biology & Medicine	90D	0	
	Metallurgy	90E	0	
	Electrotechnology	90F	2	
	Instruments	90G	0	
	Optics & Lasers	90H	0	
	Ordnance	90I	0	
	Food Technology	90J	0	

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Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>HEALTH CARE</b>		<b>44</b>		<b>2555</b>
	General	440	235	
	Planning Methodology	44A	2	
	Agency Administrative & Financial Management	44B	212	
	Community & Population Characteristics	44C	196	
	Health Care Assessment & Quality Assurance	44D	236	
	Health Care Measurement Methodology	44E	21	
	Health Care Forecasting Methodology	44F	4	
	Environmental & Occupational Factors	44G	1133	
	Health Care Technology	44H	112	
	Health Delivery Plans, Projects& Studies	44J	28	
	Health Services	44K	354	
	Health Care Needs & Demands	44L	14	
	Health Resources	44M	40	
	Health Care Utilization	44N	55	
	Health Education & Manpower Training	44P	23	
	Health Related Costs	44Q	305	
	Economics & Sociology	44R	10	
	Legislation & Regulations	44S	42	
	Data & Information Systems	44T	121	
	Health Care Delivery Organization& Administration	44U	71	
<b>INDUSTRIAL &amp; MECHANICAL ENGINEERING</b>		<b>94</b>		<b>716</b>
	General	940	131	
	Production Planning & Process Controls	94A	4	
	Quality Control & Reliability	94B	28	
	Plant Design & Maintenance	94C	1	
	Job Environment	94D	72	
	Environmental Engineering	94E	22	
	Tooling, Machinery, & Tools	94F	12	
	Manufacturing Processes & Materials Handling	94G	42	
	Industrial Safety Engineering	94H	219	
	Hydraulic & Pneumatic Equipment	94I	7	
	Nondestructive Testing	94J	48	
	Laboratory & Test Facility Design& Operation	94K	178	
<b>LIBRARY &amp; INFORMATION SCIENCES</b>		<b>88</b>		<b>1027</b>
	General	880	41	
	Operations & Planning	88A	17	
	Information Systems	88B	396	
	Marketing & User Services	88C	6	
	Personnel	88D	289	
	Reference Materials	88E	295	

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>MANUFACTURING TECHNOLOGY</b>		<b>41</b>		<b>419</b>
	General	410	30	
	Computer Aided Design CAD	41A	5	
	Computer Aided Manufacturing CAM	41B	4	
	Robotics/Robots	41C	16	
	Productivity	41D	5	
	Manufacturing, Planning, Processing & Control	41E	73	
	Joining	41F	35	
	Quality Control & Reliability	41G	68	
	Plant Design & Maintenance	41H	0	
	Job Environment	41I	77	
	Tooling, Machinery, & Tools	41J	35	
	Engineering Materials	41K	42	
	Tribology	41L	7	
	Optics & Lasers	41M	11	
	Computer Software	41N	8	
	Domestic Commerce, Marketing, & Economics	41O	2	
	Research Program Administration & Technology Transfer	41P	16	
<b>MATERIALS SCIENCES</b>		<b>71</b>		<b>1191</b>
	General	710	187	
	Ablative Materials & Ablation	71A	9	
	Adhesives & Sealants	71B	28	
	Carbon & Graphite	71C	10	
	Ceramics, Refractories, & Glass	71D	106	
	Coatings, Colorants, & Finishes	71E	93	
	Composite Materials	71F	266	
	Corrosion & Corrosion Inhibition	71G	66	
	Elastomers	71H	20	
	Fibers & Textiles	71I	77	
	Iron & Iron Alloys	71J	76	
	Lubricants & Hydraulic Fluids	71K	15	
	Materials Degradation & Fouling	71L	32	
	Miscellaneous Materials	71M	37	
	Nonferrous Metals & Alloys	71N	249	
	Plastics	71O	22	
	Refractory Metals & Alloys	71P	8	
	Solvents, Cleaners, & Abrasives	71Q	14	
	Wood & Paper Products	71R	63	



Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>MATHEMATICAL SCIENCES</b>		<b>72</b>		<b>673</b>
	General	720	40	
	Algebra, Analysis, Geometry, & Mathematical Logic	72B	302	
	Operations Research	72E	140	
	Statistical Analysis	72F	234	
<b>MEDICINE &amp; BIOLOGY</b>		<b>57</b>		<b>5965</b>
	General	570	70	
	Anatomy	57A	401	
	Biochemistry	57B	225	
	Botany	57C	267	
	Clinical Chemistry	57D	6	
	Clinical Medicine	57E	1981	
	Cytology, Genetics, & Molecular Biology	57F	287	
	Dentistry	57G	15	
	Ecology	57H	890	
	Electrophysiology	57I	5	
	Immunology	57J	42	
	Microbiology	57K	223	
	Nutrition	57L	107	
	Occupational Therapy, Physical Therapy, & Rehabilitation	57M	13	
	Parasitology	57N	22	
	Pathology	57O	18	
	Pest Control	57P	107	
	Pharmacology & Pharmacological Chemistry	57Q	228	
	Physiology	57S	446	
	Psychiatry	57T	428	
	Public Health & Industrial Medicine	57U	1982	
	Radiobiology	57V	81	
	Stress Physiology	57W	140	
	Surgery	57X	17	
	Toxicology	57Y	1007	
	Zoology	57Z	401	

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>MILITARY SCIENCES</b>		<b>74</b>		<b>3425</b>
	General	740	1676	
	Antiaircraft Defense Systems	74A	5	
	Antimissile Defense Systems	74B	18	
	Antisubmarine Warfare	74C	10	
	Chemical, Biological, & Radiological Warfare	74D	134	
	Logistics, Military Facilities, & Supplies	74E	660	
	Military Intelligence	74F	144	
	Military Operations, Strategy, & Tactics	74G	1092	
	Nuclear Warfare	74H	101	
	Passive Defense Systems	74I	1	
<b>MISSILE TECHNOLOGY</b>		<b>75</b>		<b>31</b>
	General	750	10	
	Air & Space • Launched Missiles	75A	5	
	Missile Guidance & Control Systems	75B	4	
	Missile Launching & Support Systems	75C	2	
	Missile Tracking Systems	75D	0	
	Missile Trajectories & Reentry Dynamics	75E	5	
	Missile Warheads & Fuses	75F	2	
	Surface • Launched Missiles	75G	4	
	Underwater • Launched Missiles	75H	3	
<b>NATURAL RESOURCES &amp; EARTH SCIENCES</b>		<b>48</b>		<b>3138</b>
	General	480	232	
	Mineral Industries	48A	286	
	Natural Resource Management	48B	1271	
	Natural Resource Surveys	48C	168	
	Forestry	48D	316	
	Soil Sciences	48E	175	
	Geology & Geophysics	48F	291	
	Hydrology & Limnology	48G	984	
	Snow, Ice, & Permafrost	48H	48	
	Cartography	48I	50	
<b>NAVIGATION, GUIDANCE, &amp; CONTROL</b>		<b>76</b>		<b>120</b>
	General	760	8	
	Control Devices & Equipment	76A	1	
	Guidance Systems	76B	1	
	Navigation & Guidance System Components	76C	2	
	Navigation Systems	76D	109	

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>NUCLEAR SCIENCE &amp; TECHNOLOGY</b>		<b>77</b>		<b>1234</b>
	General	770	106	
	Fusion Devices Thermonuclear	77A	28	
	Isotopes	77B	22	
	Nuclear Auxiliary Power Systems	77C	25	
	Nuclear Explosions & Devices	77D	21	
	Nuclear Instrumentation	77E	74	
	Radiation Shielding, Protection, & Safety	77F	84	
	Radioactive Wastes & Radioactivity	77G	510	
	Reactor Engineering & Nuclear Power Plants	77H	345	
	Reactor Fuels & Fuel Processing	77I	221	
	Reactor Materials	77J	4	
	Reactor Physics	77K	33	
<b>OCEAN SCIENCES &amp; TECHNOLOGY</b>		<b>47</b>		<b>1414</b>
	General	470	215	
	Marine Engineering	47A	235	
	Dynamic Oceanography	47B	99	
	Physical & Chemical Oceanography	47C	522	
	Biological Oceanography	47D	401	
	Marine Geophysics & Geology	47E	18	
	Oceanographic Vessels, Instruments,& Platforms	47F	8	
	Hydrography	47G	22	
	Underwater Construction & Habitats	47H	5	
<b>ORDNANCE</b>		<b>79</b>		<b>668</b>
	General	790	8	
	Ammunition, Explosives, & Pyrotechnics	79A	183	
	Armor	79B	36	
	Bombs	79C	2	
	Combat Vehicles	79D	65	
	Detonations, Explosion Effects, & Ballistics	79E	101	
	Fire Control & Bombing Systems	79F	13	
	Guns	79G	274	
	Rockets	79H	2	
	Underwater Ordnance	79I	19	
<b>PHOTOGRAPHY &amp; RECORDING DEVICES</b>		<b>82</b>		<b>96</b>
	General	820	2	
	Holography	82A	5	
	Photographic Techniques& Equipment	82B	82	
	Recording Devices	82C	8	

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>PHYSICS</b>		<b>46</b>		<b>2321</b>
	General	460	1015	
	Acoustics	46A	212	
	Fluid Mechanics	46B	360	
	Optics & Lasers	46C	364	
	Solid State Physics	46D	197	
	Structural Mechanics	46E	133	
	Plasma Physics	46G	67	
	Radiofrequency Waves	46H	97	
<b>PROBLEM SOLVING INFORMATION FOR STATE &amp; LOCAL GOVERNMENTS</b>		<b>43</b>		<b>3783</b>
	General	430	299	
	Finance	43A	207	
	Economic & Community Development	43B	197	
	Human Resources	43C	336	
	Police, Fire, & Emergency Services	43D	784	
	Energy	43E	180	
	Environment	43F	451	
	Transportation	43G	1390	
<b>SPACE TECHNOLOGY</b>		<b>84</b>		<b>1206</b>
	General	840	359	
	Astronautics	84A	102	
	Extraterrestrial Exploration	84B	281	
	Manned Spacecraft	84C	197	
	Spacecraft Trajectories & Flight Mechanics	84D	55	
	Space Launch Vehicles & Support Equipment	84E	180	
	Space Safety	84F	22	
	Unmanned Spacecraft	84G	262	
<b>TRANSPORTATION</b>		<b>85</b>		<b>2256</b>
	General	850	417	
	Air Transportation	85A	397	
	Metropolitan Rail Transportation	85C	45	
	Transportation Safety	85D	877	
	Pipeline Transportation	85E	30	
	Global Navigation Systems	85F	18	
	Marine & Waterway Transportation	85G	132	
	Road Transportation	85H	1137	
	Railroad Transportation	85I	73	

Major Category	Subcategory	Category Code	SRS/S&T Title Count	Category Total
<b>URBAN &amp; REGIONAL TECHNOLOGY&amp; DEVELOPMENT</b>		<b>91</b>		<b>4065</b>
	General	910	60	
	Environmental Management & Planning	91A	308	
	Transportation & Traffic Planning	91B	1343	
	Fire Services, Law Enforcement, & Criminal Justice	91C	1133	
	Communications	91D	19	
	Housing	91E	207	
	Health Services	91F	158	
	Urban Administration & Planning	91G	108	
	Regional Administration & Planning	91H	70	
	Emergency Services & Planning	91I	520	
	Economic Studies	91J	245	
	Social Services	91K	170	
	Recreation	91L	146	



# SUBJECT OPTION DESCRIPTIONS

This section gives full details on the coverage of each subject option.

## NTIS SUBJECT OPTION CATEGORY TITLES ARRANGED BY SUBJECT CATEGORY CODE

This list will assist you in using the cross reference category codes provided in many of the descriptions.

41 Manufacturing Technology	75 Missile Technology
43 Problem Solving Information for State & Local Governments	76 Navigation, Guidance & Control
44 Health Care	77 Nuclear Science & Technology
45 Communications	79 Ordnance
46 Physics	81 Combustion, Engines, & Propellants
47 Ocean Sciences & Technology	82 Photography & Recording Devices
48 Natural Resources & Earth Sciences	84 Space Technology
49 Electrotechnology	85 Transportation
50 Civil Engineering	88 Library & Information Sciences
51 Aeronautics & Aerodynamics	89 Building Industry Technology
54 Astronomy & Astrophysics	90 Government Inventions for Licensing
55 Atmospheric Sciences	91 Urban & Regional Technology & Development
57 Medicine & Biology	92 Behavior & Society
62 Computers, Control & Information Theory	94 Industrial & Mechanical Engineering
63 Detection & Countermeasures	95 Biomedical Technology & Human Factors Engineering
68 Environmental Pollution & Control	96 Business & Economics
70 Administration & Management	97 Energy
71 Materials Sciences	98 Agriculture & Food
72 Mathematical Sciences	99 Chemistry
74 Military Sciences	

Every primary subject category has a General subcategory which contains items whose subject matter falls either into several subcategories or none of the subcategories within a primary category.

In the generic example that follows, the *Primary Subject Category* is Administration & Management; the *Subject Category Code* is 70; the *Subcategory Code* is 70A; and the descriptions follow. The descriptions are the concepts contained in a report; be careful to avoid "word matching."

## 70-ADMINISTRATION & MANAGEMENT

### 70A-Inventory Control

Inventory analysis; Inventory models; Obsolescence; Repair-replacement trade-offs; Spare parts; Stock level control; Usage prediction; Warehouse automation; Stockpiling.

## 41-MANUFACTURING TECHNOLOGY

### 410-General

Includes mechanical elements; Pipes; Tubes; Levers; Cams; Springs; Clutches; Gears; Valves; Filters; Containers and packing materials; Refrigeration systems and equipment; Industrial furnaces and boilers; Heat exchangers; Heat pumps; Heat pipes; Energy management, economics, and financing; International issues.

See also 94O and 97G.

For engine components, use 81.

For fuel tanks, use 81C.

For cooling towers, use 97J.

### 41A-Computer Aided Design (CAD)

Application of computer hardware and software (programs) to enhance the design, computations, simulation, analysis and modeling, presentations, graphics, drafting, data base creation and human-machine interface, associated with the creation of engineering design specifications.

See also 94A.

### **41B-Computer Aided Manufacturing (CAM)**

Application of computer hardware and software (programs) to enhance materials planning, processing and handling, tooling; Assembly; Quality and reliability control; Inspection; Tests; Scheduling and control; Facilities and equipment maintenance; Group technology applications; Inventory control (raw material, in process and finished); Numerical controls and automation; The creation of Direct Numerical Control (DNC) and Computer Numerical Control (CNC) manufacturing cells and systems.

*See also 94A and 94G.*

### **41C-Robotics/Robots**

Application of computer hardware and software, controls, sensors, electromechanical and hydro-mechanical devices, to the creation of robots and the application of robots to all facets of manufacturing. Study of biological processes in order to develop engineering systems; Pattern recognition systems based on biological models. Includes feature extraction; Image enhancement; Image restoration; Scene analysis; Character recognition.

*See also 95F and 62F.*

### **41D-Productivity**

Productivity of employees, management, and services; Improving quality of worklife; Measurement of productivity efficiency and effectiveness; Employee attitudes and motivation; Manpower utilization and performance improvement, job satisfaction, job security; Labor-management, job redesign; Alternative work schedules; Incentive plans; Productivity barriers including regulation, obsolete practices; Paperwork, and financing methods.

*See also 70G and 70D.*

### **41E-Manufacturing, Planning, Processing & Control**

Fabrication, assembling, cleaning, and finishing; Industrial and manufacturing processes (limited to in-depth studies that directly discuss specific processes); Materials forming and machining; Heat treatment; Fabrication and manufacturing; Layout; Coating processes; Materials handling and control, including palletizing, conveying, warehousing, storing, containerization, and packaging; Time and motion studies; Scheduling; Production controls and programming; Modeling techniques and program controls; Inventory management.

*See also 94A.*

*For the beneficiation and processing of minerals, use 48A.*

*For chemical engineering and processing, use 99B.*

*For computer-aided manufacturing, use 41B and 94G.*

*For lasers used in manufacturing, use 41M.*

*For processing and packaging of food, use 98H.*

*For production of materials, use 71.*

### **41F-Joining**

Bonding and joining including gluing, welding, soldering, brazing, and fastening; Joints and fasteners; Physical, mechanical, and structural properties of adhesives, sealants, glue, binders, seals, and gaskets.

*See also 94G, 94Gen, and 71B.*

### **41G-Quality Control & Reliability**

Tolerance allocation; Maintainability requirements; Probability of satisfactory performance of components and equipment; Inspection methods; Reliability theory; Quality assurance; Nondestructive testing having industrial application; Ultrasonic, radiographic, hydrostatic, magnetic, and optical nondestructive techniques and equipment; Nondestructive testing of flaws, thickness, opacity, strength; Destructive industrial testing; Metrology.

*See also 94B, 94J, and 94O.*

### **41H-Plant Design & Maintenance**

Site selection; Plant design; Maintenance Management; Scheduled, routine, and corrective maintenance; Security.

*See also 94C.*

### **41I-Job Environment**

Industrial hygiene and occupational safety and health. *See also 57U, 68G, and 44G.* Workplace layout and design; Human factors engineering; Includes Industrial psychology and Industrial sociology; Worker interactions.

*See also 94D and 95D.*

*Includes environmental engineering equipment related to industrial use. See also 97J, 89B, and 94E.*

*For mine safety, use 48A.*

*For ordnance safety, use 79A.*

*For nuclear radiation safety, use 77.*

*For transportation safety, use 85D.*

### **41J-Tooling, Machinery, & Tools**

Machine subassemblies; Tools; Machinery including hoists, conveyors, and pumps; Design, production performance, and testing of hydraulic and pneumatic systems, accumulators, actuators, compressors and distribution equipment; Fluidic and fluoric devices; Ergonomics interaction of man and equipment in terms of subsystem and system performance requirements and evaluation; Man-machine systems and human factors engineering.

*See also 94F, 94I, 94D, and 95D.*

*For hydraulic fluids, use 71K.*

### **41K-Engineering Materials**

Performance; Properties, fabrication and manufacturing methods of ceramics, coatings and composite materials including ceramic coatings, ceramic fibers, corrosion resistant coatings, reinforced plastics, graphite or carbon composites, laminates; Metal matrix composites, and fiber and particulate composites.

*See also 71B, 71D, and 71F.*

### **41L-Tribology**

Friction, lubrication and wear, including bearings; Unwanted chemical reaction effects on metals, corrosion of metals and corrosion resistant coatings; Lubricants.

*See also 71L, 71G, and 71K.*

### **41M-Optics & Lasers**

Design and performance of optical equipment for use in manufacturing applications. Includes laser applications such as laser annealing, cutting, drilling, and welding.

*See also 46C.*

### **41N--Computer Software**

Computer programming; Programming languages; Compilers; Data base management systems; CAD/CAM robotics.

*See also 62B.*

### **41O-Domestic Commerce, Marketing, & Economics**

Economic impacts on industries; Productivity; Wage surveys; Domestic market surveys.

*See also 96A.*

### **41P-Research Program Administration & Technology Transfer**

Research needs; Technology transfer and forecasting.

*See also 70E.*

## **43-PROBLEM-SOLVING INFORMATION FOR STATE & LOCAL GOVERNMENTS**

### **430-General**

Includes internal government administration; State programs; Criminal justice, corrections planning, and administration.

### **43A-Finance**

Taxation; Revenue; Budgeting; Revenue sharing; Financing; Allocation.

*See also 91G and 91H.*

*For commercial banking and finance operations, use 96F.*

### **43B-Economic & Community Development**

*Land use planning; Urban renewal; Economic effects; Economic planning and development; Recreation planning and development; Economic readjustment.*

*See also 91J and 96A.*

### **43C-Human Resources**

Education; Social services; Health care services; Manpower.

*See also 91K and 92C.*

### **43D-Police, Fire, & Emergency Services**

Police and fire services and administration; Disaster services; Civil defense; Emergency weather services, Pollution alerts; Civil disturbances; Ambulance services; Disaster relief.

*See also 91C and 91I.*

### **43E-Energy**

Management and planning on energy resources, use and production; Government administration and forecasting.

*See also 97.*

### **43F-Environment**

Air, water, noise, waste management and planning; Monitoring services.

*See also 68.*

### **43G-Transportation**

Planning for modes of public, private, and cargo transportation; Highway planning, Parking; Traffic engineering.

*See also 85 and 91B.*

## **44-HEALTH CARE**

### **440-General**

#### **44A-Planning Methodology**

Health planning theory including methods, tactics, techniques and policies; Evaluation of planning theories and processes.

#### **44B-Agency Administrative & Financial Management**

Management practices and policies regarding technical assistance, evaluation of health care agency activities, public relations; Financial management and accounting methods.

#### **44C-Community & Population Characteristics**

Data and numerical information including health status, quality of care, malpractice, health care needs/ demands; Health care utilization, health care cost, vital statistics; Demographic information, economic, environmental, nutritional, and societal factors affecting health, and health resource distribution.

### **44D-Health Care Assessment & Quality Assurance**

Financial feasibility review, economic impact review, and project review; Certificate of need theory; Health manpower education institutional accreditation; Judicatory procedures, review, and assessment; Quality assurance theory; Certificatory methodology; Health manpower proficiency testing, and public health education evaluation; Classification of health care facilities and health care personnel.

### **44E-Health Care Measurement Methodology**

Measurement of health status, quality of care, health facility supply, health manpower supply, proficiency and productivity, and health care costs; Health care needs/demands and utilization measurement.

*See also 44L, 44N, and 44Q.*

### **44F-Health Care Forecasting Methodology**

Projecting health care needs/demands and health care utilization; Health care facility supply; Health manpower supply; Health care costs; Home health care; Cross-impact projections.

### **44G-Environmental & Occupational Factors**

Environmental factors affecting health including housing, sanitation, water pollution, solid waste pollution, noise pollution, disease vectors, safety hazards, and occupational and industrial hazards; Overpopulation; Health facility environmental considerations and environmental impact; Energy sources in the health field.

*See also 57U and 68G.*

### **44H-Health Care Technology**

Descriptions and applications of new health care technology and equipment; Ailment prevention techniques, and technology regarding diagnosis, therapy, rehabilitation, and food and nutrition; Health care equipment and facility design and performance considerations.

*See also 57 and 95.*

### **44J-Health Delivery Plans, Projects & Studies**

Plans, projects, and studies related to the institutional delivery of health services including state/local health plans, state/local medical facility plans, plans for specific health services, and health delivery feasibility studies.

### **44K-Health Services**

Personal and public health services, patient care, and maintenance of an individual's health status including hospital services acute in-patient services, long-term inpatient services, nursing home services, emergency services, public health services, mental services, nursing services, dental services, and medically-related social services including institution discharge services.

### **44L-Health Care Needs & Demands**

Measurement of health care needs/demands, hospital care, acute in-patient care, long-term in patient care, nursing home care, medical care, mental care, nursing care, dental care, and health insurance; Home health care; Measurements of health manpower requirements/demands.

*See also 44E.*

### **44M-Health Resources**

Surveys, reports, and studies related to specific health care resources including manpower, facilities, sources of financing, and government and private health-related organizations, agencies and individuals.

### **44N-Health Care Utilization**

Measurements regarding utilization of health resources including manpower, ambulatory care, emergency care, public health care, medical care, mental care, nursing care, dental care, health insurance, health care facilities, and home health care.

*See also 44E and 44L.*

### **44P-Health Education & Manpower Training**

Health manpower education including curricula and costs; Health manpower education facility needs/demands; Institutional financing; Financing for health related educational institutions; Student recruiting and retention methods; Continuing education; Career guidance and career advancement; Consumer health education and public health education methods.

### **44Q-Health-Related Costs**

Health care costs, indexes, projections, in-patient care costs, acute in-patient care costs, long-term care costs, nursing home care costs, ambulatory care costs, emergency care costs, public health care costs, medical care costs; Insurance costs; Manpower income; Equipment costs; Facility utilization and construction costs; Ailment costs including preventive medicine costs and injury costs; Transportation costs including emergency transportation costs.

### **44R-Economics & Sociology**

Discussions of economic and sociological factors and theories relevant to health care.

### **44S-Legislation & Regulations**

Laws, bills, regulations, and model legislation. Includes certificate of need, health insurance certification, health manpower licensing, health facility licensing, health manpower employment, and support regarding health manpower education.



### 44T-Data & Information Systems

Techniques regarding information systems including document sources, acquisition, surrogation, and storage; Information retrieval; Data systems, Data gathering; Data processing; Data processing hardware; Information system feasibility studies, and confidentiality of information.

### 44U-Health Care Delivery Organization & Administration

Hospital and medical practice administration and management; Organizational structure of health services; Management policies and practices regarding personnel, community participation and relations, and coordination with other agencies; Financial management and accounting methods; Financing of health delivery and facilities; Reporting methods and requirements.

## 45-COMMUNICATION

### 450-General

#### 45A-Policies, Regulations, & Studies

Licensing; Legislation; National policies and Federal regulatory controls; Frequency management; Broadcasting standards; Time signals, etc.

#### 45B-Radio & Television Equipment

Design and maintenance of radio and television transmitting and receiving equipment only.

*See also 51E.*

#### 45C-Common Carrier & Satellite

All communication equipment except radio and television. Optical, radio, microwave, wire, and acoustic communication; Telephone, telemeter, telegraph, television, and radio communication systems; Computer network communications; Digital communication; Intercommunication systems; Optical scanning.

*For information systems, see also 88B.*

*For design and construction of communication satellites, see also 84G.*

#### 45D-Sociopolitical

Propaganda; Social communication; Sign language, Effects of communication on society and behavior; Postal service; Mass media communication.

#### 45E-Graphics

Publishing; Printing; Graphic arts; Reprography; Xerography; Facsimile; Desk top publishing.

#### 45F-Verbal

Research and development in vocal communication; Speech intelligibility; Speech recognition.

### 45G-Communication & Information Theory

Theoretical studies relating to the measurement and transmission of information in a communication channel. Includes coding theory, information capacity, detection of signals in noise.

*See also 62E.*

## 46-PHYSICS

### 460-General

Includes electron and X-ray optics; Thermodynamics; Nuclear physics; elementary particles; Atomic and molecular physics.

#### 46A-Acoustics

Generation and transmission of sound through various media or enclosures. Includes ultrasonic and infrasonic radiation.

*See also 63A.*

#### 46B-Fluid Mechanics

Theoretical and experimental studies of the dynamics and statics of fluids and of relative motion between fluids and solid bodies; Aerodynamics and hydrodynamics; Water tunnel studies and equipment.

*For wind tunnel equipment and facilities, use 51F.*

*For operational applications, use 51A, 75E, and 84D.*

*For plasma physics, use 46G.*

#### 46C-Optics & Lasers

Generation and propagation of electromagnetic waves in the infrared, visible, and ultraviolet region of the spectrum; Theory; Design and performance of optical equipment; Lasers and masers.

#### 46D-Solid State Physics

Physical properties of solids as related to their structure. Fundamental research and theoretical studies on semiconductors, superconductors, structure of solids. Includes crystallography and superconductivity.

*For semiconductor devices, use 49H.*

*For structural mechanics, use 46E.*

*For studies on ceramics, coatings, composite materials, metals, and alloys, use 71.*

#### 46E-Structural Mechanics

Dynamics and statics of solid bodies; Kinematics; Shock and vibration.

#### 46G-Plasma Physics

Properties and actions of plasmas, including magnetohydrodynamics, pinch effect, plasma oscillations, plasma jets; Plasma diagnostics; Plasma dynamics. Plasmas in thermonuclear devices.

*See also 77A.*

*For MHD generators, use 97O.*

*For astrophysics, use 54C.*

*For aeronomy, use 55A.*



**46H-Radiofrequency Waves**

*Generation and propagation of radiofrequency waves. For communication systems, techniques, equipment, etc., use 45.*

*For radiofrequency detection, use 63H.*

**47-OCEAN SCIENCES & TECHNOLOGY****470-General**

Includes breakwaters; Onshore and offshore facilities; Ocean dredging operations; Beach erosion; Harbor engineering; Ocean mining; Anchors; Buoys; Seakeeping; Diving operations and equipment; Decompression equipment.

*See also 50B, 47H, and 95E.*

**47A-Marine Engineering**

Design, construction, and maintenance of ships, boats, and related equipment; Salvage operations; Naval architecture; Shipyards and shipbuilding; Submarines; Shipborne containerization.

*See also 85G.*

**47B-Dynamic Oceanography**

Ocean waves; Sea level changes; Ocean currents; Ocean tides; Littoral transport; Sea ice movement.

**47C-Physical & Chemical Oceanography**

Physical and chemical properties of sea water, the ocean bottom, and estuaries; Sea ice.

*For glaciers and fresh water ice, use 48H.*

**47D-Biological Oceanography**

Plant and animal life in the marine environment; Biological fouling; Marine ecology; Biological aspects of mariculture; Use of marine organisms as bioassay systems; Marine aspects of estuaries; Marine biology of anadromous fishes.

*See also 57C, 57H, 57K, 57F, 57Z, and 98F.*

**47E-Marine Geophysics & Geology**

Geophysical and geological studies and surveys as applied to a marine environment; Plate tectonics; Sea floor spreading; Continental drift.

*See also 48F.*

**47F-Oceanographic Vessels, Instruments, & Platforms**

Instrumentation and equipment to collect and process oceanographic data; Remote sensors.

**47G-Hydrography**

Hydrographic surveying; Ocean bottom topography; Bathymetry.

**47H-Underwater Construction & Habitats**

Closed environments; Underwater work and construction; Underwater construction equipment.

*See also 470 or 95E.*

**48-NATURAL RESOURCES & EARTH SCIENCES****480-General****48A-Mineral Industries**

Industries and their processes that exploit metallic and nonmetallic, fuel and nonfuel resources. Includes coal mining, mining wastes, and acid mine drainage; Coal preparation; Petroleum exploration, drilling, and production; Metals exploration and mining; Exploration geophysics and seismology; Reserves; Mine safety; Mineral economics; Underwater and continental shelf mining; Natural resources studies (excluding Earth Resource Satellite Surveys).

*If energy source production related, use 97.*

*For petroleum refining, use 97K and 99B.*

**48B-Natural Resource Management**

Conservation and management of natural resources, including land and soil, water, forest, grassland, and other vegetation; Fish and wildlife management; Mineral management; Policies and legislation including game laws and licensing; Water resource management; Water supply; Deforestation; Forest fire prevention.

*See also 98F, 48A, 48C, and 48D.*

**48C-Natural Resource Surveys**

Use of scientific satellites, aerial photography, and other remote sensing techniques to scan the earth's surface in data gathering experiments on soils, mineral resources, hydrology, animals, forests, and other resources; Surveying techniques such as image processing, photointerpretation, and pattern recognition.

*For agricultural resource surveys, use 98G;*

*For equipment studies, use 63.*

**48D-Forestry**

Forest description and measurement; Forest influences; Forest protection and management; Harvesting, logging, sawmills, and transportation; Silviculture; Forest nurseries; Afforestation reforestation, and deforestation; Forest fires and prevention.

*For wood utilization, use 71R.*

**48E-Soil Sciences**

Soil biology, chemistry, moisture, mineralogy, classification, surveys; Soil erosion and its prevention; Land reclamation, terracing, contouring, polders, tillage, and fertility; Soil banks.

*For irrigation, use 98C.*

*For mechanical and engineering properties, use 50D.*

**48F-Geology & Geophysics**

Structure, properties, and classification of rocks;  
Paleontology; Stratigraphy; Geodesy; Structural  
geology; Engineering geology; Vulcanology;  
Petrology; Petrography; Tectonics.

*For astrogeology, use 54A.*

*For geological studies relating to energy or mineral  
reserves, use 97A and 48A respectively.*

*For marine geology and geophysics, use 47E.*

**48G-Hydrology & Limnology**

Properties, distribution, and circulation of fresh water,  
including its surface and underground occurrence;  
Physical and chemical conditions in fresh water  
bodies; Eutrophication; Chemical-biological  
interrelationships; Water runoff; Water losses;  
Ground water; Streams; Aquifers.

*For studies of estuaries or sea water, use 47.*

**48H-Snow, Ice, & Permafrost**

Physical characteristics including trafficability,  
stability, and mechanical properties; Glaciology.

*For sea ice, use 47C, and for sea ice movement, use  
47B.*

**48I-Cartography**

Map making; Photogrammetry; Terrain models;  
Topography. Geographic information systems;  
Cartography; Actual physical processes, procedures,  
and methods of map making.

**49-ELECTROTECHNOLOGY****490-General**

Includes standards, measurements, and  
instrumentation not applied to any other  
subcategories.

**49A-Antennas**

Antennas; Antenna theory; Antenna radiation patterns;  
Radomes.

**49B-Circuits**

Circuit theory; Network analysis; Filters; Oscillators;  
Logic circuits; Printed circuits; Electronic modules;  
Commutators; Power supply circuits; Waveform  
generators; Analog to digital converters; Phase  
locked systems.

*For integrated circuits, use 49H.*

**49C-Electromechanical Devices**

Electric motors; Relays; Mechanical switches;  
Connectors; Circuit breakers; Electric fuses.

**49D-Electron Tubes**

*All electron tubes except those in 49E.*

**49E-Optoelectronic Devices & Systems**

Display systems; Phototubes; Image tubes; Cathode  
ray tubes; Electroluminescent panels; Light  
emitting diodes; Photodiodes; Phototransistors;  
Magneto-optics; Electro-optics; Optical detectors,  
including infrared and ultraviolet detectors.

*See also 63C and 63F.*

*For solar cells, see also 97N.*

*For lasers, use 46C.*

**49F-Power & Signal Transmission Devices**

Transmission lines; Electric wire and cable;  
Waveguides; Fiber optics transmission lines.

**49G-Resistive, Capacitive, & Inductive  
Components**

Resistors; Capacitors; Inductors; Transformers;  
Electromagnets; Potentiometers; Thermistors; Delay  
lines; Transducers; Crystal resonators. Includes  
miscellaneous and basic components.

**49H-Semiconductor Devices**

Transistors; Semiconductor diodes; Integrated circuits.  
*For photodiodes, phototransistors, light emitting  
diodes, and optical detectors, use 49E.*

**50-CIVIL ENGINEERING****500-General****50A-Highway Engineering**

Construction of roads and highways; Highway and  
rights-of-way maintenance including weed control;  
Bridges and bridge systems; Highway paints and  
markings; Highway and road signs; Beautification;  
Slope stability and soil subbases.

**50B-Civil Engineering**

Dredging; Dams; Water purification; Reservoir  
engineering; Flood control; Sewers; Waterway  
engineering; Runway construction; Shore protection;  
Breakwaters; Harbor engineering; Tunneling.

*See also 47.*

*For sewage treatment, use 68D.*

*For building construction, use 89.*

*For oil and gas reservoir engineering, use 97 or 48A.*

**50C-Construction Equipment, Materials, &  
Supplies**

Excavation and earth moving equipment; Hoisting and  
conveying equipment; Concrete and cement.

*See also 89G.*

*For properties of concrete and cement, see also 71D.*

**50D-Soil & Rock Mechanics**

Physical properties of soil and rock for utilization in  
engineering; Landslides; Soil stabilization.

*For soil sciences, use 48E.*

*For soil conservation, use 48B.*

*For geology and geophysics, use 48F.*

## 51-AERONAUTICS & AERODYNAMICS

### 510-General

Includes landing mats.

### 51A-Aerodynamics

Aerodynamic characteristics and problems of bodies as they are affected by the dynamics of phenomena relating to boundary layer, lift, drag, laminar and turbulent flow, compressible flow, lift, aerodynamic heating, vortex flow, wake, etc. in aerodynamic regimes. Includes aircraft, ground vehicles, and structures.

*See also 46B.*

*For missile reentry dynamics, use 75E.*

*For spacecraft reentry dynamics, use 84D.*

### 51B-Aeronautics

Aircraft operations such as takeoff and landing, all weather and night flight, taxiing, approach, letdown, in-flight refueling, etc. Includes aviation accidents.

### 51C-Aircraft

Design, production, and maintenance of aircraft, aircraft components and equipment. Structural studies of airframes, bodies, wings, fuselages; Military and commercial aircraft; Balloons (excludes meteorological balloons); Air cushion vehicles (excludes tracked vehicles).

*See also 85A and 81D.*

*For meteorological balloons, use 55D.*

*For tracked air cushion vehicles, use 85C.*

*For electronic equipment, use 51E.*

### 51D-Parachutes & Decelerators

Deployable devices and structures to induce drag and deceleration of aircraft, spacecraft, and test vehicles such as rocket sleds.

### 51E-Avionics

Airborne electronic equipment. Includes electronic equipment used for communications; Navigation; Control systems; Onboard air traffic control; Detection.

*See also 45, 49, 63, and 76.*

### 51F-Test Facilities & Equipment

Wind tunnels; Simulators; Flight simulators.

*For flight simulators used for training, use 92A.*

## 54-ASTRONOMY & ASTROPHYSICS

### 540-General

### 54A-Astrogeology

Studies of the structure and composition of planets and other bodies in the solar system.

*For geology and geophysics, see also 48F.*

### 54B-Astronomy & Celestial Mechanics

Positions and motions of the celestial bodies; Ephemerides, Eclipses.

### 54C-Astrophysics

Physical and chemical aspects of celestial bodies, their origin and evolution. Includes astronomical spectroscopy, radio astronomy, solar structure, and planetary atmospheres.

### 54D-Cosmic Ray Research

Detection and analysis of cosmic rays.

## 55-ATMOSPHERIC SCIENCES

### 550-General

### 55A-Aeronomy

Physics and chemistry of the upper atmosphere; Composition; Chemical reactions; Aurora; Airglow; Solar-terrestrial relationships.

*For cosmic ray research, use 54D.*

### 55B-Dynamic Meteorology

Studies of atmospheric motions; Atmospheric diffusion models; Atmospheric circulation.

*For air pollution movement studies, use 68A.*

### 55C-Meteorological Data Collection, Analysis, & Weather Forecasting

Climatology; Satellite meteorology; Weather prediction; Ice forecasting.

### 55D-Meteorological Instruments & Instrument Platforms

Instruments used to record meteorological parameters; Meteorological balloons; Weather stations; Sounding rockets; Remote sensors.

### 55E-Physical Meteorology

Acoustical, electrical, optical, and thermodynamic properties of the atmosphere; Cloud physics; Precipitation theory; Global warming.

*See also 68A.*

### 55F-Weather Modification

Change of weather conditions through artificial means; Fog dispersal; Artificial precipitation.

## 57-MEDICINE & BIOLOGY

### 570-General

### 57A-Anatomy

Descriptive and comparative anatomy of humans; Anthropometry; Dissection; Neuroanatomy; Morphology.

*For plant anatomy, use 57C.*

*For animal anatomy, use 57Z.*

### 57B-Biochemistry

Studies of the chemical processes which take place in biological systems. Identification and measurement of biochemical substances and methods of analysis, including assaying.

*See also 57F, 57L, 57Q, and 99A.*

*For measurement of biochemical substances for clinical diagnoses, use 57D.*

### 57C-Botany

Study of macroscopic and microscopic plants; Plant anatomy, physiology, pathology, and taxonomy; Phytotoxicity; Includes algae and diatoms.  
*See also 57H, 57K, 57Y, and 98D.*

### 57D-Clinical Chemistry

Techniques and instrumentation for chemical analysis of body fluids, including blood, and tissues for clinical diagnoses.  
*See also 99A.*

### 57E-Clinical Medicine

Prevention, diagnosis, and therapy of diseases; Nuclear medicine; Experimental medicine; Clinical protocols.  
*See also 57J, 57O, and 57X.*  
*For veterinary medicine, use 98E.*  
*For health care services, use 44.*  
*For epidemiology and disease control, use 57U.*

### 57F-Cytology, Genetics, & Molecular Biology

Origin, structure, and functions of living cells and cell components; Hereditary diseases; Use of chemistry and physics to study biological phenomena on the molecular level; Structure and function of biological macromolecules, e.g. proteins and nucleic acids.  
*See also 57B.*

### 57G-Dentistry

Prevention, diagnosis, and treatment of diseases of the teeth, oral cavity, and associated parts; Oral hygiene.  
*For dental materials and equipment, use 95C.*  
*For dental prosthetics, use 95A.*  
*For dental services, use 44.*

### 57H-Ecology

Interrelationships of organisms and their environment; Animal, plant, and human ecology; Marine, fresh water, and terrestrial ecology; Ecosystems; Adaptation; Acclimatization; Natural selection; Species diversity; Food chains; Energy balance; Ecological succession; Effects of polluted environments on organisms; Biological productivity.  
*See also 47D, 48B, 48G, 57C, 57Y, 57Z, 68, 98D, and 98B.*  
*For effects of extreme environments or stimuli on humans, use 57W.*  
*For the interrelationships of humans and their social environments, use 92.*  
*For the effects of industrial environments on humans, use 57U.*

### 57I-Electrophysiology

Electrical activity associated with living organisms and life processes; Electrophysiologic recording including electrocardiography, electroencephalography, and electromyography; Neural transmission; Intracellular potential; Bioelectricity; Bioluminescence; Responses of organisms to electrical stimulation.

### 57J-Immunology

Mechanisms of immune responses; Antigens and antibodies; Vaccines; Immune serums; Immunization; Immunopathology; Immunohematology; Immunochemistry; Serology; Immunity; Allergy; Histocompatibility; Autoimmune diseases. HIV/AIDS.  
*See also 57E and 57K.*

### 57K-Microbiology

Studies of microscopic plants and animals; Vaccine and interferon production; Microbial metabolism and biochemistry.  
*For diagnosis and therapy of infectious diseases, use 57E.*  
*For disease control and epidemiology, use 57U.*  
*For biotechnology applications, see also field of application.*

### 57L-Nutrition

Processes by which humans assimilate and utilize food substances; Experimental nutrition; Nutritive value of foods; Malnutrition; Diet; Food habits; Nutrition surveys; Nutritional requirements; Clinical nutrition.  
*For food processing, use 98H.*  
*For animal nutrition related to animal husbandry, veterinary medicine or zoology, use 98E or 57Z.*

### 57M-Occupational Therapy, Physical Therapy, & Rehabilitation

Restoration of normal form and function after injury or physical illness; Occupational therapy; Physical therapy; Vocational rehabilitation.  
*See also 44K, 92A, 95A.*  
*For mental rehabilitation, use 57T.*  
*For social rehabilitation, use 92C and 91K.*  
*For rehabilitation centers, use 44K.*

### 57N-Parasitology

Parasites and parasitism; Host-parasite interactions; Vectors of parasites; Parasitic diseases; Life cycles of parasites.  
*See also 57H, 57K, and 57P.*

### 57O-Pathology

Studies of the structural and functional changes in tissues and organs which cause or are caused by diseases, trauma or injuries; Gross pathology; Histopathology; Cytopathology; Pathophysiology; Comparative and experimental pathology; Histological techniques; Autopsy.  
*For plant diseases, use 98D.*  
*For animal diseases, use 98E.*  
*For diagnosis and treatment of diseases, use 57E.*  
*For immunopathology, use 57J.*



### 57P-Pest Control

Agents and methods for the control of plant and animal pests; Pesticides, algicides, herbicides, insecticides, molluscicides, fungicides, rodenticides, etc.; Repellants and attractants; Fumigation and extermination; Traps; Biological pest control.

*See also 68E and 98C.*

*For ecological aspects of pest control, use 57H.*

### 57Q-Pharmacology & Pharmacological Chemistry

Synthesis, composition, properties, and effects of drugs; Pharmacy, Pharmacodynamics.

*See also 57Y.*

*For social effects of drugs, use 91C and 92C.*

*For radiopharmaceuticals, use 57V.*

*For business studies of the drug industry, use 96A.*

### 57S-Physiology

Functions of the human organism and its parts and comparative physiology; Metabolism; Endocrinology; Neurophysiology; Respiration; Biological rhythms; Growth; Aging; Regeneration.

*See also 57B, 57F, 57J, and 57L.*

*For plant physiology, use 57C.*

*For animal physiology, use 57Z and 98E.*

*For psychophysiology, use 57T and 92B.*

*For electrophysiology, use 57I.*

*For pathophysiology, use 57O.*

*For stress physiology, use 57W.*

### 57T-Psychiatry

Prevention, diagnosis, and treatment of mental, emotional, and behavioral disorders; Psychopathology; Psychoanalysis; Neuropsychiatry; Orthopsychiatry; Psychotherapy; Psychophysiology; Psychophysics.

*For psychological mechanisms and processes, use 92B.*

### 57U-Public Health & Industrial Medicine

Protection and improvement of community health; Effects of environments on public health; School and public health programs, services, and education; Health screening; Health statistics; Epidemiology; Toxic and infectious disease control; Preventive medicine; Hygiene and sanitation; Drinking water quality; Industrial hygiene and medicine; Safety engineering; Occupational safety and health; Industrial safety and detection equipment; Site-specific investigations.

*See also 94D, 94H, 41I and 68G.*

*For occupational and For occupational and environmental factors related to health planning, use 44G.*

### 57V-Radiobiology

Biological effects of radiation; Dosimetry; Health physics; Radiation sickness and injury; Radiation hazards; Radiation protection; Radiopharmaceuticals. Includes electromagnetic, ultrasonic, and particle radiation.

*See also 68F and 99E.*

*For radioecology, use 57H.*

*For nuclear medicine, radiology, and radiotherapy, use 57E.*

### 57W-Stress Physiology

Effects of extreme environments or stimuli on human biological processes; Physiological effects of motion, gravity, sound, temperature, electromagnetic, fields, pressure, sensory deprivation, and fatigue; Acclimatization. Includes aerospace and underwater medicine.

*See also 51B, 57H, and 84.*

*For plants, use 57C.*

*For animals, use 57Z.*

*For stress psychology, use 92B or 57T.*

### 57X-Surgery

Treatment of diseases, injuries, and deformities by manual or operative methods; Organ and tissue transplantation; Pre-and post-management of surgical patients; Experimental surgery.

*See also 95A and 95B.*

*For dental surgery, use 57G.*

*For histocompatibility, use 57J.*

### 57Y-Toxicology

Study of the adverse effects of substances on biological systems and the diagnosis and treatment of toxic diseases; Toxicity studies; Risk assessment of chemicals; Antidotes.

*See also 57C, 57Q, 57S and 57Z.*

### 57Z-Zoology

Animal anatomy and physiology; Natural history; Animal behavior; Taxonomy.

*See also 47D, 48B, 57Y, and 98F.*

*For animal models used in biomedical research, use the research discipline.*

*For laboratory and domesticated animal care, or animal diseases, use 98E.*

## 62-COMPUTERS, CONTROL & INFORMATION THEORY

### 620-General

Includes computer security; Artificial intelligence; Signal processing (unapplied).



### 62A-Computer Hardware

Design and development of computers and peripheral equipment, including analog computers, digital computers, hybrid computers, special purpose computers, minicomputers, microcomputers; Computer accessories, supplies and installation; Logic circuits; Computer architecture; Computer network hardware.

*For computer hardware applied to a specific application, see the field of application.*

*For Very Large Scale Integration (VLSI), use 49H.*

### 62B-Computer Software

Computer programming; Programming languages; Compilers; Data base management systems; Software tools; Software reliability; Computer graphics.

*For computer software and database development applied to a specific application, see the field of application.*

*For CAD/CAM, use 41A and 41B.*

### 62C-Control Systems & Control Theory

Theoretical studies of open-loop and closed-loop control systems; Automatic control systems; Principles including adaptive, continuous, digital, distributed parameter, linear, multivariable, nonlinear, optional, predictive, and proportional; Process controllers.

*See also 720.*

*For control systems applied to a specific application, see the field of application.*

### 62D-Information Processing Standards

Standards for the use of automatic data processing equipment and systems. Includes standards for hardware, software, applications, and data; Federal Information Processing Standards (FIPS).

### 62E-Information Theory

Theoretical studies relating to the measurement and transmission of information in a communication channel, including coding theory, information capacity, and detection of signals in noise.

*See also 45G.*

### 62F-Pattern Recognition & Image Processing

Includes feature extraction; Image enhancement; Image restoration; Scene analysis; Character recognition; Barcoding; Computer vision.

### 62R-Applications Software

### 62S-Data Files

## 63-DETECTION & COUNTERMEASURES

### 630-General

Automated access control systems.

*For industrial security, see also 94Gen.*

### 63A-Acoustic Detection

Techniques and equipment used for the detection and tracking of objects by means of sound waves, including ultrasonic and infrasonic radiation; Sonar.

*For acoustic testing, use 94.*

*For detection techniques applied to chemistry, meteorology, astronomy, oceanography, medicine, and manufacturing, use 99, 55, 54, 47, 57, 41, and 94, respectively.*

### 63B-Electromagnetic & Acoustic Countermeasures

Interception, jamming, antijamming, and deception of acoustic and electromagnetic signals; Techniques to nullify the use of detection, surveillance, guidance, and communication systems; Radar jamming; Chaff; Counter-countermeasures.

*See also 74.*

### 63C-Infrared & Ultraviolet Detection

Techniques and equipment for the detection and tracking of objects by infrared and ultraviolet radiation; Infrared night vision devices; Infrared homing.

*See also 76B.*

*For earth resource surveys, use 48C and 98G.*

*For mapping, use 48I.*

*For photography, use 82B.*

*For nondestructive testing, use 94J.*

*For detection techniques applied to chemistry, meteorology, astronomy, oceanography, medicine, and manufacturing, use 99, 55, 57, 41, and 94, respectively.*

### 63D-Magnetic Detection

Techniques and equipment for the detection of objects by means of magnetic fields.

*For geomagnetism, use 48.*

### 63E-Nuclear Explosion Detection

Techniques and equipment for the detection of nuclear explosions at high altitude, underground, and in space. Includes the use of shock waves, earth movement, and measurement of nuclear radiation levels.

*See also other applicable subcategories in 63, especially 63I.*

### 63F-Optical Detection

Techniques and equipment for the detection by means of light. Includes the use of binoculars, periscopes, telescopes, and night vision devices for object detection, and smoke particle detectors.

*See also 46C.*

*For detection using only infrared or ultraviolet radiation, use 63C.*

*For earth resources surveys, use 48C and 98G.*

*For photography, use 82B.*

*For detection techniques applied to chemistry, meteorology, astronomy, oceanography, medicine, and manufacturing, use 99, 55, 54, 47, 41, and 94, respectively.*

## 63G-Personnel Detection

Techniques and equipment for the detection of personnel. Includes the use of acoustic, seismic, olfactory, chemical, and optical detectors; Antiintrusion devices; Motion detectors; Security devices.

*For military passive defense systems, see also 74I.*

## 63H-Radiofrequency Detection

Techniques and equipment for the detection and tracking by means of radiofrequency waves; Radar; Microwave detection; See also 76.

For mapping, use 48I.

*For detection techniques applied to meteorology, astronomy, oceanography, medicine, and manufacturing, use 55, 54, 57, 41, and 94 respectively.*

## 63I-Seismic Detection

Techniques and equipment for the detection of objects by means of seismic waves.

*For earthquake detection, use 48F.*

*For seismic prospecting, use 48A.*

# 68-ENVIRONMENTAL POLLUTION & CONTROL

## 680-General

Any study covering multiple types of pollution.

Includes broad pollution studies, such as life-cycle analysis of wastes.

## 68A-Air Pollution & Control

Air pollution from flue gases, exhaust gases, odors, dust, smog, microorganisms, etc.; Control techniques and equipment; Sampling and analytical techniques, and equipment; Waste gas recovery; Biological and ecological effects; Air pollution chemistry; Acid precipitation; Atmospheric motion; Laws, legislation, and regulations; Public administration; Economics; Land use.

*See also 43F, 91A, 57, 85, 81, 99A, 99B, and 97R.*

*For effects on human health, use 68G.*

*For pesticides and radioactive contaminants, use 68E and 68F respectively.*

## 68B-Noise Pollution & Control

Pollution in the environment by noise from any source including engine noise, traffic and transportation noise, machinery noise, industrial noise, urban noise, sonic boom; Theory and devices for control; Biological and ecological effects; Noise detection; Building technology; Laws, legislation, and regulations; Public administration; Land use.

*See also 41I, 43F, 91A, 46A, 57, 85, 89, 94D, and 97R.*

*For effects on human health, use 68G.*

## 68C-Solid Wastes Pollution & Control

Pollution by solid wastes including garbage, scrap, junked automobiles, spoil, sludge, containers; Disposal methods such as composts or land application, injection wells, incineration, sanitary landfills; Mining wastes; Processing for separation and materials recovery; Solid waste utilization; Recycling; Biological and ecological effects; Superfund (Records of Decision, etc.); SITE technology; Laws, legislation, and regulations; Public administration; Economics; Land use. Includes disposal of concentrated or pure liquids such as brines, oils, chemicals, and hazardous materials.

*See also 43F, 91A, 57, 99B, and 97R.*

*For effects on human health, use 68G.*

*For the disposal of pesticides and radioactive contaminants, use 68E and 68F.*

*For the controlled disposal of radioactive wastes from nuclear reactors, use 77G.*

## 68D-Water Pollution & Control

Pollution by municipal wastes, agricultural wastes, industrial wastes, mine wastes, radioactive contaminants; Chemistry and analysis of pollutants; Thermal pollution; Oil pollution; Control techniques and equipment; Sewage treatment; Industrial waste water pretreatment; Hydrology and limnology; Biological and ecological effects; Waste water reuse; Laws, legislation, and regulations; Public administration; Economics; Land use.

*See also 43F, 91A, 47, 48G, 57, 97R, 98, 99A, and 99B.*

*For effects on human health, use 68G.*

*For pollution by pesticides and radioactive contaminants, use 68E and 68F respectively.*

*For the design and construction of sewers, and drinking water treatment, use 50B.*

## 68E-Pesticides Pollution & Control

Pollution by insecticides, herbicides, fungicides, rodenticides; Residues; Decomposition studies; Analysis and detection; Soil chemistry and biology; Adverse biological effects; Ecology; Laws, legislation, and regulations; Public administration; Economics.

*See also 57, 68A, 68C, 68D, 43F, 91A, 98, and 99A.*

*For effects on human health, use 68G.*

## 68F-Radiation Pollution & Control

Involves pollution of the environment by particle and electromagnetic radiation from natural and synthetic sources, including neutrons, X-rays, ultraviolet radiation, microwaves, alpha particles; Radon; Sampling and analytical techniques; Fallout; Biological and ecological effects; Laws, legislation, and regulations; Public administration; Economics.

*See also 57, 68A, 68C, 68D, 91A, 97R.*

*For effects on human health, use 68G.*

*For the controlled disposal of radioactive wastes from nuclear reactors, use 77G.*

### **68G-Environmental Health & Safety**

Effects of pollution on public health and safety;

Toxicology; Industrial health; Physiology;

Psychology; Clinical medicine; Radiobiology;

Animals used as research experimental models.

*See also 41I, 57, 44G, 68A, 68B, 68C, 68D, 91A, 43F, 94D, and 97R.*

### **68H-Environmental Impact Statements**

Only actual draft and final statements are posted in this subcategory. Environmental impact statements describing national effects are posted here and to other appropriate subcategories.

*For studies about environmental impact statements, use 680.*

## **70-ADMINISTRATION & MANAGEMENT**

### **700-General**

*Organizational structure and organization theory.*

### **70A-Inventory Control**

Inventory analysis; Inventory models; Obsolescence;

Repair-replacement trade-offs; Spare parts; Stock

level control; Usage prediction; Warehouse

automation; Stockpiling.

### **70B-Management Practice**

Theory and concepts of management including record keeping, planning, scheduling, organization, coordination, decision making, policy making; Productivity management; Cost effectiveness; Systems management; Contact management; Management methods (PERT, PPB, etc.); Management games. Applied studies are classified in the application.

*For research management, use 70E.*

### **70C-Management Information Systems**

Information systems which include data collection, data processing, and information delivery for use in decision making an evaluation by managers; Manual and automated systems.

*See also 88B.*

### **70D-Personnel Management, Labor Relations & Manpower Studies**

Selection, recruitment, management, utilization, and evaluation of personnel; Job descriptions; Job analysis; Salary administration; Labor supply; Labor unions; Arbitration and bargaining; Industrial relations; Fringe benefits, and incentives; Manpower allocation requirements and utilization.

*For library and information science personnel, use 88D.*

*For health personnel, use 44P.*

### **70E-Research Program Administration & Technology Transfer**

Research management, development, and forecasting;

Research contract management; Research needs;

Technology transfer and forecasting. Excludes

research methods per se. Studies of specific programs are excluded unless they discuss a program at the national level, technology innovation, or trends and impacts of new technology.

### **70F-Public Administration & Government**

National, state, and local government structure, operation, and administration. Operations of government agencies and their interactions; Intergovernmental relations.

*See also 43, 91G, and 91H.*

### **70G-Productivity**

Productivity of businesses, government, employees, management, and services; Improving quality of

work life; Measurement of productivity efficiency

and effectiveness; Employee attitudes and

motivation, manpower utilization and performance improvement, job satisfaction, job security;

Labor-management cooperation, joint committees

participative management, job redesign; Alternative

work schedules; Incentive plans. Productivity

barriers including regulations, obsolete practices,

paperwork, and financing methods.

*See also 70B, 70D, 70F, 96A, and 96G.*

*For specific applications of productivity to manufacturing, use 41D and 94.*

## **71-MATERIALS SCIENCES**

### **710-General**

Advanced materials.

*See also 41K.*

### **71A-Ablative Materials & Ablation**

Physical, mechanical, and structural properties;

Performance; Fabrication and manufacturing

methods; Equipment directly related to processing;

Ablation processes and chemistry; Reentry vehicle heat shields.

*For production planning, use 41 and 94.*

### **71B-Adhesives & Sealants**

Adhesives; Glues; Binders; Sealants; Seals; Gaskets;

Physical, mechanical, and structural properties;

Performance; Fabrication and manufacturing;

Equipment directly related to processing.

*See also 71L and 94G.*

*For concrete cements, use 50C and 89G.*

*For propellant binders, use 79A and 81H.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*



### 71C-Carbon & Graphite

Carbon and graphite fibers and textiles; Charcoal; Carbon black; Carbon and graphite coatings; Industrial diamonds; Physical, mechanical, and structural properties; Performance, fabrication and manufacturing methods; Equipment directly related to processing.

*See also 71A, 71E, 71F, 71I, 71L, and 94G.*

*For carbon and graphite composites, use 71F.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71D-Ceramics, Refractories, & Glass

Glasses; Brick; Porcelain; Ceramic coatings; Ceramic fibers; Physical, mechanical, and structural properties; Performance; Fabrication and manufacturing; Equipment directly related to processing; Studies of individual structural members; Cement properties.

*See also 71E, 71I, 71L, and 94G.*

*For concrete and cement used as building materials, use 50C and 89G.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71E-Coatings, Colorants, & Finishes

Paints and primers; Varnishes; Corrosion resistant coatings; Coating pigments; Carbon, ceramic, plastic, rubber and metal coatings; Physical, mechanical and structural properties; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Electroplating; Electrodeposition; Flame and plasma spraying; Vapor deposition.

*See also 71G, 71L, and 94G.*

*For surface treatment not involved with coatings, use 94G.*

*For dielectric and semiconducting films, use 46 and 49.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71F-Composite Materials

Materials composed of two or more physically distinct constituents; Reinforced plastics, graphite or carbon composites; Laminates; Metal matrix composites; Fiber and particulate composites; Physical, mechanical, and structural properties; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members.

*See also 71L and 94G.*

*For wood composites, use 71R.*

*For concrete and reinforced concrete, use 50C and 89G.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71G-Corrosion & Corrosion Inhibition

Unwanted chemical reaction effects on metals;

Corrosion of metals; Rusting; Corrosion inhibitors; Corrosion resistant coatings; Corrosion electrochemistry.

*See also 71E and 71L.*

*For concrete corrosion, use 50C and 89G.*

### 71H-Elastomers

Rubbers; Additives; Curing agents; Elastomer polymerization; Physical, chemical, mechanical, and structural properties; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members.

*See also 71E, 71I, 71L, 94G, and 99C.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71I-Fibers & Textiles

Glass, carbon, ceramic, metal, and polymeric fibers; Threads, yarns, textile, and fiber finishing, including dyeing and sizing; Physical, chemical, mechanical, and structural properties; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members; Flame resistance.

*See also 71L and 94G.*

*For fiber composites, use 71F.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71J-Iron & Iron Alloys

Includes steels or alloys containing more than 50% iron. Coatings; Fibers; Extractive metallurgy; Refining; Embrittlement; Physical, mechanical, and structural properties; Microstructure; Phase studies; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members.

*See also 71E, 71I, and 71L.*

*For corrosion, use 71G.*

*For beneficiation, use 48A.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71K-Lubricants & Hydraulic Fluids

Solid and liquid lubricants; Additives; Greases; Drilling fluids; Brake fluids; Physical, chemical, mechanical and structural properties; Performance; Manufacturing; Equipment directly related to processing; Chemical synthesis.

*See also 71L and 41L.*

*For pollution studies, use 68. For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71L-Materials Degradation & Fouling

Aging; Erosion and cavitation erosion; Wear; Weathering; Decay; Effects of radiation on materials; Biodeterioration, including fungus deterioration.

*See also 71C, 71D, 71F, 71H, 71I, 71J, 71K, 71N, and 71R.*

*For nuclear reactor materials degradation, see also 77I or 77J. If concerned with nuclear propulsion, use 81I.*

### 71M-Miscellaneous Materials

Materials not included in another group, including leather, fur, refrigerants, and waxes; Physical, mechanical, and structural properties; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members.

*See also 94G.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71N-Nonferrous Metals & Alloys

Includes studies not specifying the type of metal.

Coatings; Fibers; Extractive metallurgy; Refining; Embrittlement; Physical, mechanical, and structural properties; Microstructure; Phase studies; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; studies of individual structural members.

*See also 71E, 71I, and 71L.*

*For metal fabrication, use 94G.*

*For corrosion, use 71G.*

*For beneficiation, use 48A.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71O-Plastics

Additives; Curing agents; Plastic coatings; Plastic polymerization; Physical, chemical, mechanical, and structural properties; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members.

*See also 71E, 71L, 94G, and 99C.*

*For plastic composites, use 71F.*

*For polymeric fibers, use 71I.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71P-Refractory Metals & Alloys

Includes only the following metals and alloys having more than 50% of these metals: iridium, molybdenum, niobium (columbium), osmium, rhenium, tantalum, and tungsten. Coatings; Fibers; Extractive metallurgy; Refining; Embrittlement; Physical, mechanical, and structural properties; Microstructure; Phase studies; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members.

*See also 71E, 71I, and 71L.*

*For metal fabrication, use 94G.*

*For corrosion, use 71G.*

*For beneficiation, use 48A.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71Q-Solvents, Cleaners, & Abrasives

Cleaning compositions; Solvents; Detergents; Soaps and abrasives; Cleaning action of these materials; Physical and chemical properties; Performance; Manufacturing; Equipment directly related to processing.

*For cleaning techniques, use 94G.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

### 71R-Wood & Paper Products

Sawing and milling; Lumbering; Plywood, particle and fiber board; Wood product fabrication; Pulp, papermaking, and conversion processes; Physical, chemical, mechanical, and structural properties; Performance; Fabrication and manufacturing methods; Equipment directly related to processing; Studies of individual structural members.

*See also 94G.*

*For forestry and tree production, use 48D.*

*For pollution studies, use 68.*

*For industry economics and marketing, use 96.*

*For production planning, use 41 and 94.*

## 72-MATHEMATICAL SCIENCES

### 720-General

#### 72B-Algebra, Analysis, Geometry, & Mathematical Logic

Algebra and number theory, including field theory (algebra), group theory, ring theory; Analysis, including calculus of variations, complex variables, differential equations, Fourier analysis, functional analysis, functions (mathematics), measure, and integration; Geometry, tensor analysis, and topology; Mathematical logic, including foundations of mathematics, lattices (mathematics), metamathematics, and set theory.

*For applications of mathematics, see the appropriate category of application.*



### **72E-Operations Research**

Game theory; Queueing theory; Management games; Mathematical models; Mathematical programming; Network flows; Search theory.

*See also Managerial practice, 70B.*

*For operations research applied to a specific application, see the field of application.*

### **72F-Statistical Analysis**

Analysis of variance; Correlations techniques; Discriminate analysis; Distribution theory; Experimental design; Factor analysis; Nonparametric statistics; Probability theory; Regression analysis; Statistical decision theory; Statistical inference; Statistical tests; Stochastic processes.

*For statistical analysis applied to a specific application, see the field of application.*

## **74-MILITARY SCIENCES**

### **740-General**

#### **74A-Antiaircraft Defense Systems**

Tactical and terminal countermeasures against attacking aircraft that includes tracking and computing equipment, antiaircraft guns, rockets, and missiles.

*For specific missiles and rockets, use 75.*

#### **74B-Antimissile Defense Systems**

Point and terminal defense and countermeasures against air-, surface-, or underwater-launched missiles, bombardment satellites. Includes land based and shipborne tracking and computing systems; Strategic Defense Initiatives (SDI), Star Wars; ballistic missile defense.

#### **74C-Antisubmarine Warfare**

Operations conducted against submarines, their supporting forces and operating bases. Include air, surface, and underwater operations.

*See also 63.*

#### **74D-Chemical, Biological, & Radiological Warfare**

Design, development, and utilization of chemical, biological, and radiological weapons; Production, generation, and stability of lethal and nonlethal agents; Biological agents including anticrop and defoliating agents.

*For nuclear weapons, use 74H.*

#### **74E-Logistics, Military Facilities, & Supplies**

Procurement, storage, distribution, issue, repair, replacement of military equipment; Deployment of troops and cargo; Industrial mobilization; stock level controls and inventory techniques; Defense conversion; Downsizing; Base closures; Force reduction; Dual Use Technology; Continuous Acquisition and Life-cycle Support (CALS), formerly Computer Aided Acquisition and Logistics Support.

*For related civilian studies, use 70 and 94.*

### **74F-Military Intelligence**

Techniques for collecting, evaluating, and disseminating information concerning foreign nations. Includes damage assessment; Surveillance and reconnaissance systems.

### **74G-Military Operations, Strategy, & Tactics**

Joint and combined operations, campaigns, battles, invasions, theater operations; Planning analysis, appraisal, and threat evaluation; Methods of attack and support; Armed Forces maneuvers; Limited and unconventional warfare; Sabotage, insurgency, and counterinsurgency; Guerrilla warfare; Psychological and cold warfare.

### **74H-Nuclear Warfare**

Design, development, and applications of nuclear weapons and devices; Studies of the physical effects of nuclear weapons; Arms control.

*For nuclear guided missile warheads, use 75F.*

### **74I-Passive Defense Systems**

Systems, structures, and devices to provide area monitoring security and denial. Includes camouflage, barbed wire, minefields, warning systems, barriers, and other anti-intrusion devices.

*For civil defense, see also 91I.*

*For personnel detection, see also 63G.*

## **75-MISSILE TECHNOLOGY**

### **750-General**

#### **75A-Air & Space-Launched Missiles**

Design, construction and performance of missiles launched from aircraft or spacecraft. 75B-Missile Guidance & Control Systems Techniques for guidance and control of missiles from launching to impact. Includes optical guidance, television guidance, wire guidance, preset and terminal guidance, inertial guidance, command guidance, and homing guidance.

#### **75B-Missile Guidance & Control Systems**

Techniques for guidance and control of missiles from launching to impact. Includes optical guidance, television guidance, wire guidance, preset and terminal guidance, inertial guidance, command guidance, and homing guidance.

#### **75C-Missile Launching & Support Systems**

Missile handling and launching. Includes transportation, storage, and preparation for launching; Air, space, surface, and underwater launching and support equipment and techniques; Checkout equipment and procedures; Guided missile ranges.

#### **75D-Missile Tracking Systems**

Techniques and systems for tracking missiles as defensive measures. Can be from surface installations or air and spaceborne platforms.

*For antimissile defense systems, use 74B.*

### **75E-Missile Trajectories & Reentry Dynamics**

Determination, analysis, and processing of missile trajectory data; Flight path analysis; Impact prediction; Atmospheric reentry. Includes aerodynamic studies.

*For spacecraft reentry, use 84D.*

### **75F-Missile Warheads & Fuses**

Design and performance of all types of missile warheads and fuzes-chemical, biological, nuclear and explosive.

*For rockets, use 79H.*

### **75G-Surface-Launched Missiles**

Design, construction, and performance of missiles launched from the ground, surface platforms, vehicles, silos, and surface ships.

### **75H-Underwater-Launched Missiles**

Design, construction, and performance of missiles launched from underwater.

## **76-NAVIGATION, GUIDANCE, & CONTROL**

### **760-General**

#### **76A-Control Devices & Equipment**

Navigation and guidance control equipment.  
*See also 76C.*

#### **76B-Guidance Systems**

Design, development, and performance of complete guidance systems. Includes integration of specific components and subsystems necessary to assure course positioning.

#### **76C-Navigation & Guidance System Components**

Navigation computers; Gyros, radiators, sensors, indicators, etc., used in navigation of aircraft, ships, spacecraft, and ground vehicles.

#### **76D-Navigation Systems**

Design, development, and performance of complete navigation systems; Integration of specific components and subsystems necessary in direction finding (position, distance, and course of travel); Global navigation systems.

*See also 85F.*

## **77-NUCLEAR SCIENCE & TECHNOLOGY**

### **770-General**

Includes nuclear materials management, safeguards, accounting methods.

*See also 77I.*

#### **77A-Fusion Devices (Thermonuclear)**

Theory, design, construction, and operation of devices for producing controlled thermonuclear fusion reactions; Nuclear fusion reactor materials and fuels.

*For plasma studies in thermonuclear devices, see also 46G.*

### **77B-Isotopes**

Identification, separation, and concentration of radioactive isotopes. Includes isotopic irradiation devices.

*For radioactive isotopes polluting the environment, use 68F.*

*For the use of isotopes in labeling chemical reactions, use 99F.*

*For the use of isotopes in medical/biological applications, use 57.*

### **77C-Nuclear Auxiliary Power Systems**

SNAP technology, both isotopic and reactor; Isotopic power supplies; Small scale electricity generation by nuclear means.

*For nuclear propulsion, see the field of application.*

### **77D-Nuclear Explosions & Devices**

Explosion effects, including shock waves, ground motion, electromagnetic pulses, primary radiation, injection of charged particles into radiation belts; Testing of nuclear devices (including nuclear simulation using chemical explosives); Peaceful applications (e.g., Plowshare).

*For effects on communications and electronics systems, see the field of application.*

*For military applications, use 74H.*

### **77E-Nuclear Instrumentation**

Nuclear radiation detection and measurement devices and systems; Beta particle detectors.

*For X-ray detectors, use 46Gen.*

*For health physics instrumentation, use 57V.*

### **77F-Radiation Shielding, Protection, & Safety**

Shielding design, nuclear radiation transport properties of materials, decontamination; Container design and transportation requirements for radioactive materials; Fallout shelters.

*See also 91I.*

### **77G-Radioactive Wastes & Radioactivity**

Separation, processing, handling, storage, disposal, and reuse of radioactive wastes; Radioactive fallout; Fission products; Man-made or natural radioactivity; Decommissioning.

*For radiation pollution, use 68F.*

### **77H-Reactor Engineering & Nuclear Power Plants**

Engineering related directly to the design, safety, and operation of a reactor; Research and test reactors. Integrated assemblage, including reactor and turbogenerator equipment, plus control and regulatory devices of a nuclear power plant, either mobile or stationary; Includes site selection and feasibility studies; Engineering aspects of reactor accidents.

*See also 77C.*

*For critical assemblies and reactor simulation, use 77K.*

### **77I-Reactor Fuels & Fuel Processing**

Production, testing, design, or reclamation of nuclear fuel materials, reactor fuel elements (includes cladding) and fuel assemblies. Includes nuclear fuel cycle studies for nuclear materials management; Nuclear fuel reprocessing.

*For processing of nonrecoverable fuel materials and fuel contaminants, use 77G.*

### **77J-Reactor Materials**

Production, testing, design, or reclamation of coolants, control materials, moderators, structural materials such as pipe materials; Shielding materials, and steels. Includes fabricated elements or assemblies and specific configurations.

*For the effects of radiation on materials, see also 71L or 71J.*

*For fuel materials, cladding, or fuel assemblies, use 77I.*

*Excludes power generating equipment and nuclear fusion reactor materials.*

### **77K-Reactor Physics**

Reactor kinetics, reactor theory, neutron transport theory, and criticality. Includes critical assemblies and reactor simulators.

## **79-ORDNANCE**

### **790-General**

#### **79A-Ammunition, Explosives, & Pyrotechnics**

Projectiles, fuzes, demolition explosives, detonators, grenades, land mines, high explosives, primers, powder and liquid propellants, flame throwers, and equipment for handling these items; Production, performance, storage stability of incendiaries, pyrotechnics, screening agents (smokes), etc.

*For nuclear weapons, use 74H.*

*For rocket propellants, use 81.*

#### **79B-Armor**

Design, testing, and performance of armor and armor plate including bullet proof, flak proof, explosion proof, and fragment proof devices and related equipment.

*For other types of protective devices, see the application.*

#### **79C-Bombs**

High-explosive, fragmentation, antipersonnel, armor piercing, incendiary, napalm, general purpose, and similar types of bombs; Bomb handling equipment; Storage.

*For bomb directors and bomb release mechanisms, use 79F; For nuclear bombs, use 74H.*

#### **79D-Combat Vehicles**

Military vehicles including armored wheeled and track-laying vehicles, tanks and reconnaissance vehicles, trucks, gun carriers; Components and accessories.

### **79E-Detonations, Explosion Effects, & Ballistics**

Explosion effects (except nuclear) such as blast, shock waves, detonation waves, cratering, earth motion or movement, heat, etc.; Interior, exterior, and terminal ballistics; The study of motion, behavior, and aerodynamics of projectiles thrown or launched by ordnance projectors; Includes target vulnerability and damage assessment studies, weapons effects.

*For nuclear explosion effects, use 77D.*

### **79F-Fire Control & Bombing Systems**

Fire control computers, sights, directors, range finders, gunlaying, bombing radar systems, boresighting, bomb releases, and other devices used specifically for directing the firing of weapons or the dropping of bombs.

### **79G-Guns**

Small arms, automatic weapons, antipersonnel weapons, recoilless weapons, mortars, artillery and naval guns, their accessories and components; Gun carriages, gun mounts, remote control equipment, etc.

*For ballistic studies, use 79E.*

*For gun control, social violence, use 92C or 43.*

### **79H-Rockets**

Unguided, self-propelled projectiles whose trajectory or course cannot be altered after launch; Ground launched, air launched, or ship launched rockets, launchers, and launch support equipment.

*For sounding rockets, use 55D.*

### **79I-Underwater Ordnance**

Torpedoes, submarine mines, depth charges, hydrobombs, antisubmarine ammunition, etc.; Launching devices and support equipment.

## **81-COMBUSTION, ENGINES, & PROPELLANTS**

### **810-General**

#### **81A-Combustion & Ignition**

Autoignition, ignition, and combustion. Includes flame studies; Combustion products studies; Ignition systems; Combustion chemistry; Flammability studies.

*See also 89 and 94H.*

#### **81B-Electric & Ion Propulsion**

All types of engines deriving power from free ions and electrons. Includes ion, plasma, and arc jet systems; Propulsion by means of solar wind; Laser propulsion.

*For electrically propelled surface vehicles, use 85.*

### **81C-Fuel & Propellant Tanks**

Design, performance, and testing of fuel and propellant tanks including those for automobiles, petroleum products, and rocket propellants.

### **81D-Jet & Gas Turbine Engines**

Design, performance, and testing of all types of jet and gas turbine engines, their components, engine nozzles. Includes Ramjet, Scramjet, and Turbofan engines, and hydroduct and turbomachinery as well as nonpropulsive turbines.

*See also 97L and 51C.*

### **81G-Rocket Engines & Motors**

Design, performance, and testing of rocket engines and motors and their components.

### **81H-Rocket Propellants**

Production, handling, stability, and performance of liquid, solid, thixotropic, and exotic propellants. Includes fuels, oxidizers, additives, and binders.

*For combustion and ignition, use 81A.*

### **81I-Nuclear Propulsion**

Design, performance, and testing of nuclear engines for surface, air, and space propulsion.

*See also 85.*

### **81J-Reciprocation & Rotating Combustion Engines**

Design, performance, and testing of reciprocating and rotating engines of various configurations for all types of propulsion. Includes internal and external combustion engines; Engine exhaust systems; Engine air systems components; Engine structures; Stirling and diesel engines.

*See also 97L and 85H.*

## **82-PHOTOGRAPHY & RECORDING DEVICES**

### **820-General**

#### **82A-Holography**

Techniques, materials, and uses of holography and holograms; Acoustic holography.

*See also 46C.*

#### **82B-Photographic Techniques & Equipment**

Photographic techniques, including aerial photography, color photography, astronomical photography, cinematography, photomicrography, Schlieren photography; Cameras, lenses, shutters, projectors, photographic processes, and materials; Microphotography, Photographic copying; Direct recording and reproduction of visual images; Copying, reproduction and replication techniques; Thermography; Lithography, and related arts; Graphic arts, illustrating, visual design.

*For photogrammetry, use 48I.*

### **82C-Recording Devices**

Techniques and devices for recording other than visual images. Includes disk, magnetic, thermoplastic, electrostatic recording systems, CD-ROM, and playback equipment such as record players, tape recorders, etc.

## **84-SPACE TECHNOLOGY**

### **840-General**

Extraterrestrial biology, chemistry, and medicine.

### **84A-Astronautics**

Space missions; Projects and logistics; Orbital rendezvous; Space exploration; Spacecraft operating problems; Extravehicular activity.

### **84B-Extraterrestrial Exploration**

Space probe exploration; Space landings; Space construction and maintenance; Extravehicular activity on other planets.

### **84C-Manned Spacecraft**

Design and construction of manned spacecraft, space stations, aerospace planes and their components.

### **84D-Spacecraft Trajectories & Flight Mechanics**

Determination, analysis, processing of spacecraft trajectory data; Space mechanics; Orbital calculations; Flight path analysis; Atmosphere entry; Reentry dynamics.

### **84E-Space Launch Vehicles & Support Equipment**

Handling and launching, including transportation, storage, preparation for launching, countdown, launching equipment, checkout equipment, ground support equipment, and information systems; Spacecraft tracking systems; Tracking networks; Recovery support.

### **84F-Space Safety**

Safety measures and devices directed toward reducing the hazards of spaceflight.

### **84G-Unmanned Spacecraft**

Design and construction of unmanned spacecraft, including space probes, scientific satellites, military satellites, communication satellites, reconnaissance satellites, and navigational satellites.

*For satellites applied to a specific application, see the field of application.*

## **85-TRANSPORTATION**

### **850-General**



## 85A-Air Transportation

Operation of systems for transport by air; Civil aviation; Airports and airport access; Airline operations; Air routing; Air traffic control systems; Multimodal systems; Aviation safety and aviation accidents; Aircraft fires; Aircraft fuel fires.

*See also 43G, 74E, 76, 85D, and 91B.*

*For design of aircraft and components, use 51 and 81.*

*For runway construction and design, use 50B.*

## 85C-Metropolitan Rail Transportation

Urban rail transit; Underground and above-ground rapid transit railways, including subways; Automated guideway transit systems; Tracked air cushion vehicles.

*See also 85I and 91B.*

## 85D-Transportation Safety

Safety and accidents involving air, land, and water transportation; Accident studies and prevention; Alcohol related studies; Breakaway barriers and structures; Standards and testing of components and equipment; Crashworthiness; Traffic safety; Collision research; Safety equipment and devices.

*See also 91B.*

*For pipeline accidents, use 85E.*

## 85E-Pipeline Transportation

Transportation of liquids, gases, and slurries through long-distance pipelines; Accidents and safety.

## 85F-Global Navigation Systems

Worldwide navigational aids to transportation; Global positioning system (GPS).

*See also 76D.*

## 85G-Marine & Waterway Transportation

Shipping; Safety and accidents; Safety equipment; Cargo handling and equipment; Cargo movement; Passenger movement; Traffic control; Boating; Trade routes; Shipborne containerization.

*See also 43G, 74E, 76, and 85D.*

*For marine engineering, use 47A.*

*For waterway engineering, use 50B.*

## 85H-Road Transportation

Passenger and cargo movement; Design and standards for vehicles and components; Motor vehicle engine studies; Safety engineering; Safety devices; Traffic and road safety; Collision research; Accident studies; Highway traffic; Traffic engineering; Passenger and cargo vehicles; Trailers; Motorcycles; Bicycles and bikeways; Hiking trails.

*See also 43G, 50A, 74E, 81J, 85D, and 91B.*

## 85I-Railroad Transportation

Safety and accidents; Safety equipment; Cargo handling and equipment; Cargo movement; Passenger movement; Traffic control; Terminals; Amtrak; Track studies; Rolling stock; Scheduling; Railroad engineering and equipment.

*See also 43G, 85D, and 91B.*

## 88-LIBRARY & INFORMATION SCIENCES

### 880-General

Includes general studies about microforms; Film readers; Copyrights; Privacy Act; Report writing.

### 88A-Operations & Planning

Acquisitions, classification, cataloging, abstracting, and indexing; Circulation and reference systems; Information services; Interlibrary loans; Distribution; Manual and computerized information retrieval; Individual libraries and information center.

*For library or information networks, use 88B.*

### 88B-Information Systems

Library and information networks; Operations and planning of these systems; File maintenance and management; Database management; Information superhighway, National Information Infrastructure; Applied information systems (Management, medical, transportation, etc.)

*See also 44T, 62, and 70C.*

*For database management, use 62B.*

*For communications and computer networks, use 45C.*

*For geographic information systems, see 48I.*

### 88C-Marketing & User Services

User needs, surveys; Promotions; Fees.

### 88D-Personnel

Training and education; Selection; Management; Performance; Schools and accreditation.

*See also 70D.*

### 88E-Reference Materials

Bibliographies; Directories; Glossaries; Catalogs; Thesauri; Indexes; Abstract and title periodicals.

## 89-BUILDING INDUSTRY TECHNOLOGY

### 890-General

Includes fires in buildings.

### 89B-Architectural Design & Environmental Engineering

Architecture; Human engineering; Site surveys; Interior design; Lighting; Heating, ventilating, and air conditioning; Heat loss studies. Includes environmental engineering equipment.

*See also 97J and 94E.*

### 89C-Construction Management & Techniques

Excavation; Fabrication (presite and onsite); Construction techniques; Reconstruction; Management including planning, manpower, and labor studies.

### 89D-Structural Analyses

Dynamics and statics of structures and structural members including kinetics, kinematics, vibration and stress analyses; Induced environmental stresses including earthquakes, wind, and flood; Foundation stresses; Soil-structure interactions.



### 89E-Building Standards & Codes

Standards and codes for buildings, equipment, components, and materials.

### 89G-Construction Materials, Components, & Equipment

Plumbing; Wiring; Insulation; Doors and windows; Walls; Joints; Beams; Construction equipment such as bulldozers and cranes. Includes flammability and fire studies. Cement and concrete.

*See also 50C.*

*For cement properties, see also 71D.*

### 89H-Building Equipment, Furnishings, & Maintenance

Equipment including security alarms (i.e. Burglar alarms), elevators, and fire safety devices; Furnishings, including major household appliances, rugs, and furniture; Maintenance, including repair, pest control, and cleaning.

*For environmental engineering equipment, use 89B.*

## 90-GOVERNMENT INVENTIONS FOR LICENSING

*For patents and patent applications only (will be labeled as such in the report title); Not for bibliographies.*

### 900-General

Computer software.

### 90A-Mechanical Devices & Equipment

Devices and equipment for fuel ignition; Heating, illumination, and refrigeration; Cleaning; Printing; Product handling and transportation; Sprinklers; Fire extinguishers; Safety; Motor and other land vehicles; Earthworking and excavating; Tools; Jacks; Hydraulic and pneumatic systems; Power transmissions; Couplings, fasteners, and joints; Piping; Drilling and mining; Separators; Locks; Sewing machines; Winding and reeling; etc.

*For metal shaping and forming, use 90E.*

*For medical equipment, use 90D.*

### 90B-Chemistry

Organic and inorganic compounds; Batteries; Electrochemistry; Hydrocarbons; Lubricating compositions; Propellants and rocket fuels; Acids; Polymers; Plastics; Inks; Bleaching; Dyeing; Fertilizers; Food fermentation; Sugar and starch; Paper making; Textiles; Paints; Coatings (except metal coatings); Chemical reactors; etc.

### 90C-Nuclear Technology

Reactors; Radioactive materials; Nuclear instrumentation; Nuclear radiation safety; Nuclear power plants and reactor engineering; Nuclear fusion; Particle accelerators; Plasma devices; etc.

### 90D-Biology & Medicine

Drugs; Cosmetics; Prosthetics; Medical equipment; Pesticide biology; Biological laboratory equipment; Life support equipment.

### 90E-Metallurgy

Metal stock; Metal coatings; Molding, shaping, and treating processes; Laminating; Glasses; Material shaping; Sheet metal and wire working; Bonding and joining; Cutlery; etc.

*For use of mechanical equipment, use 90A.*

### 90F-Electrotechnology

Antennas, circuits, and electromechanical devices; Electron tubes; Optoelectronic devices; Power and signal transmission devices; Resistive, capacitive and inductive components; Semiconductor devices; Information transmission, storage, and retrieval; Communications; etc.

### 90G-Instruments

Photographic equipment; Measuring and testing instruments and equipments; Acoustic devices; Etc.

*For nuclear instruments, use 90C.*

### 90H-Optics & Lasers

Optical materials, components, equipment, and systems; Infrared, visible, ultraviolet, and X-ray lasers; Masers.

### 90I-Ordnance

Production and performance of projectiles, fuzes, explosive materials, pyrotechnics, and weapon systems (not limited to military applications); Ordnance storage systems; Fire control systems; Weapons delivery systems; Missiles, rockets, and propellants directly related thereto; Weapons carriers (tanks, aircraft ships, etc); Guns; Laser weapons; Bombs.

### 90J-Food Technology

Pasteurizing, curing, canning, dehydrating, freezing, irradiation, freeze drying, etc., of foods and other agricultural products; Sanitation and fumigation of products; Food additives and preservatives; Analysis and inspection of products; Storage, packaging, and display of products; Cooking devices.

*For food fermentation, use 90B.*

## 91-URBAN & REGIONAL TECHNOLOGY & DEVELOPMENT

### 910-General

Includes energy studies.

### 91A-Environmental Management & Planning

Air, water, noise, and waste management and control; Monitoring services; Solid wastes and recycling; Solid waste landfills; Water quality management; Environmental surveys; Design and operation of sewer systems (combined, etc.); Water supplies and services; Excludes natural resource management. *See also 68 and 43F.*

### 91B-Transportation & Traffic Planning

Planning for modes of public and private, passenger and cargo transportation; Travel patterns and demand; Parking; Traffic engineering, traffic flow and control; Traffic surveys; Highway and street services; Rapid transit systems; Passenger transportation and planning; Pedestrian movement. *See also 43G and 85.*

### 91C-Fire Services, Law Enforcement, & Criminal Justice

Fire, police, and court services and their administration; Law enforcement and criminal justice; Crime and fire prevention; Personnel recruitment, training, and utilization; Parole; Work release; Correctional institutions. *See also 43D.*  
*For criminal justice and corrections, see also 430.*

### 91D-Communications

Use and planning of communications; Mass media, emergency communications, public information. *See also 45.*

### 91E-Housing

Surveys and assessments of existing housing; Planning and development; Building codes; Housing needs; Housing renovation; Public housing. *For design, architectural, or construction related studies, see also 89.*

### 91F-Health Services

Urban health services; Emergency medical services; Mental health services; Nursing homes; Ambulatory health services; Hospital services; Public health access. *See also 43C, 43D, 44 and 91I.*

### 91G-Urban Administration & Planning

General administration and planning; Feasibility studies; Appraisal of real property; Taxation; Land use and zoning; Urban revitalization; Financing. *See also 43 and 70F.*

### 91H-Regional Administration & Planning

General administration and planning for county and regional areas that may also contain urban or urbanized areas; Intergovernmental relations and interactions (State, County, Local); Land use and zoning. *See also 43 and 70F.*  
*For state government administration and planning, use 43.*

### 91I-Emergency Services & Planning

Disaster services; Civil defense; Early warning systems and emergency preparedness for all types of disaster; Emergency weather services; Pollution alerts; Civil disturbances; Ambulance services; Flooding; Disaster relief. *See also 43D, 44, and 91F.*  
*For military passive defense systems, see also 74I.*  
*For personnel detection, see also 63G.*

### 91J-Economic Studies

Economic analyses; Economic development; Industrial development; Economic impacts of development; Population-economy-income studies; Employment and earnings; Property values; Commercial area studies. *See also 43B and 96.*  
*For government financial operations, use 43A, 70F, 91G, and 91H.*

### 91K-Social Services

Child care; Family and youth counseling; Social rehabilitation; Foster homes and adoption; Welfare and public assistance; Financial assistance; Food stamp services; Employment services; Legal services. *See also 43C, 91F, and 92C.*

### 91L-Recreation

Planning and administration; Facilities; Public opinion; Economic and social aspects; Safety aspects; Use of recreational vehicles; Cultural activities; Sports; Parks, including national parks.

## 92-BEHAVIOR & SOCIETY

### 920-General

Includes general overall census studies; Political science.

### 92A-Job Training & Career Development

Vocational training; On-the-job training; Retraining; Vocational rehabilitation; Use and design of training simulators (including flight simulators) and equipment; Instructional aids; Professional development; Career development. *For curriculum development, use 92D.*

### 92B-Psychology

Human behavior; Personality; Intelligence; Learning ability; Judgement; Motivation; Perception; Job satisfaction; Leadership characteristics; Psychometrics; Adaptability; Social, industrial, group, organizational, interpersonal, and experimental psychology; Clinical psychology; Physiological psychology. *For the measurement of hearing, vision, heart rate, respiration and other physiological responses as related to behavior, use 57T or 57W.*

### 92C-Social Concerns

Sociology and sociometrics; Race relations; Age group and minority group studies; Social rehabilitation of drug abusers, alcoholics, physically, emotionally, and mentally handicapped, offenders, etc.; Cultural and economic deprivation; Social discrimination; Immigration; Demography; Social services, including child care, welfare, counseling, financial assistance, and employment and unemployment services; Attitude studies.  
*See also 43C, 44, and 91K.*

### 92D-Education, Law, & Humanities

Formal education; School systems; Educational administration; Curricula; Instructional devices and materials, including audiovisual; Teaching methods; Computer-assisted instruction; Laws; Linguistics; Machine translation; Fine arts; Archaeology; History; Anthropology; Humanities; Religion.

### 92E-International Relations

Political and social indicators; Crises and crisis management; Conflict analysis; Foreign aid; Foreign policy and foreign affairs; International political science; Disarmament and arms control; Espionage; Includes international relationships concerning territorial seas, fishing, extradition, and natural resources.  
*See also 74H.*  
*For international commerce, use 96C.*

## 94-INDUSTRIAL & MECHANICAL ENGINEERING

### 940-General

Includes bearings; Mechanical elements; Pipes; Tubes; Levers; Cams; Springs; Mechanical joints; Containers and packing materials; Refrigeration systems and equipment; Industrial furnaces and boilers; Heat exchangers; Heat pumps; Heat pipes; Industrial security; Metrology.  
*For rocket engine components, use 81G.*  
*For fuel tanks, use 81C; For cooling towers, use 97J.*  
*For nuclear security, use 77Gen.*

### 94A-Production Planning & Process Controls

Materials control; Numerical control and automation; Time and motion studies; Scheduling; Production controls and programming; Modeling techniques and program controls; Inventory management.  
*See also 44A, 41A and 41B.*

### 94B-Quality Control & Reliability

Tolerances allocations; Maintainability requirements; Probability of satisfactory performance of components and equipment; Inspection methods; Destructive industrial testing; Reliability theory; Quality assurance.  
*See also 41E and 41G.*

### 94C-Plant Design & Maintenance

Site selection; Plant design; Layout; Maintenance management; Scheduled, routine, and corrective maintenance.  
*See also 41H.*

### 94D-Job Environment

Industrial hygiene and occupational diseases and injuries in settings such as factories, and office and commercial buildings; Industrial psychology; Industrial sociology; Workplace layout and design; Worker interactions.  
*See also 44G, 57U, 41I, and 92B.*  
*For industrial safety engineering and accident prevention, use 94H.*

### 94E-Environmental Engineering

Lighting; Heating; Ventilating; Air conditioning. Includes environmental engineering equipment related to industrial use. Excludes pollution control.  
*See also 41I, 89B and 97J.*

### 94F-Tooling, Machinery, & Tools

Machine subassemblies; Robots; Robotics; Tools; Machinery, including hoists, conveyors and pumps.  
*See also 41C and 41J.*

### 94G-Manufacturing Processes & Materials Handling

Fabrication, assembling, cleaning, and finishing; Industrial and manufacturing processes (limited to in-depth studies that directly discuss specific processes); Bonding and joining, including gluing, welding, soldering, and brazing; Materials forming and machining; Heat treatment; Coating processes; Materials handling, including palletizing, conveying, warehousing, storing, containerization, and packaging.  
*See also 71, 41B, 41E, and 41F.*  
*For processing and packaging of food, use 98H.*  
*For production of materials, use 71.*  
*For chemical engineering and processing, use 99B.*  
*For the beneficiation and processing of minerals, use 48A.*

### 94H-Industrial Safety Engineering

Accident prevention; Safety measures; Fire prevention; Warning systems; Safety equipment, structures, and clothing.  
*For industrial safety engineering applied to a specific application, use the field of application.*

### 94I-Hydraulic & Pneumatic Equipment

Design, production, performance, and testing of hydraulic and pneumatic systems, accumulators, actuators, compressors, and distribution equipment; Fluidic and fluoric devices.  
*See also 41J.*  
*For hydraulic fluids, see 71K.*

### **94J-Nondestructive Testing**

Nondestructive testing having industrial application; Ultrasonic, radiographic, hydrostatic, magnetic, and optical nondestructive techniques and equipment; Nondestructive testing of flaws, thickness, opacity, strength.

*For destructive industrial testing, use 94B.*

### **94K-Laboratory & Test Facility Design & Operation**

Measuring, testing, and simulation devices. Includes laboratories, test facilities, and test equipment measuring testing and simulation. If the test facility, equipment, etc. is applied to a specific application, use the field of application.

## **95-BIOMEDICAL TECHNOLOGY & HUMAN FACTORS ENGINEERING**

### **950-General**

#### **95A-Prosthetics & Mechanical Organs**

Includes materials and equipment going into human bodies, enabling them to function properly, either temporarily or permanently. Artificial limbs and limb braces; Facial prosthetics, including artificial eyes; Dental prosthetics; Mechanical organs and mechanical hearts; Circulatory assist devices; Artificial kidneys, etc.; Biocompatible materials including tissue adhesives, tissue compatible materials, and antithrombogenic materials.

*For prosthodontics, use 57G.*

#### **95B-Tissue Preservation & Storage**

Preservation of organs, tissue, and blood for transplantation or transfusion to living organs; Blood and tissue banks; Properties and evaluation of preserved and stored materials.

*See also 57J, 57S, and 57X.*

#### **95C-Biomedical Instrumentation & Bioengineering**

Includes materials and equipment used to monitor human body functions. Design, use, and performance of biomedical equipment; Biotelemetry including biotelemetry transducer and transmitter equipment; Hospital equipment and supplies; Dental materials and equipment; Equipment for physiological monitoring; Diagnostic equipment; Biomedical laboratory equipment.

*See also 95A.*

### **95D-Human Factors Engineering**

Design of tools, instruments, equipment, and machinery with emphasis on optimum utilization by humans; Habitability of work and living space; Ergonomics; Interaction of man and equipment in terms of subsystem and system performance requirements and evaluation. Encompasses manual controls, tactical kinesthesia, and other human sensory modalities involved in operation of equipment and understanding of personnel subsystems; Man-machine systems. Includes anthropometric studies, protective equipment, protective clothing, and life support systems.

### **95E-Life Support Systems**

Equipment and techniques for sustaining life in foreign environments, such as space, underground, and underwater; Closed ecological systems (includes pressure suits, diving gear, and breathing apparatus). *See also 95D.*

### **95F-Bionics & Artificial Intelligence**

Study of biological processes in order to develop engineering systems; Simulation of biological processes; Comparative studies of control systems formed by the brain and nervous system; Pattern recognition systems based on biological modes; Biological applications of information theory; Cybernetics.

### **95G-Protective Equipment**

Equipment providing protection against such environmental elements as heat, cold, noise, machinery, and radiation.

*For equipment and techniques for sustaining life in environments where normal respiration is not possible, use 95E.*

## **96-BUSINESS & ECONOMICS**

### **960-General**

Includes economic theory; Business and economic census studies; Insurance not covered by another subcategory; Small businesses.



## 96A-Domestic Commerce, Marketing, & Economics

National and state-level studies; Industrial costs and economics; Economic impact of industries; Economic impacts on industries; Industrial statistics; Agricultural economics; Productivity; Labor supply and demand; Labor costs and economics; Inflation; Economic aspects of unemployment; Employment and unemployment statistics; Wage surveys; United States commerce; Wholesale and retail trade; Domestic market surveys; Business, personal, and property taxes; Income tax data; Franchising.

*See also 43B, 70D, 91J, and 98B.*

*For studies of individual plants or operations, see the field of application; For economic impacts of individual plants or operations, see the field of application.*

*For regional development, use 43B and 91J.*

## 96C-International Commerce, Marketing, & Economics

Foreign market surveys and research; International trade; Imports and exports; Customs and tariffs; Multinational businesses; Trends and forecasting.

*For international finance, use 96F.*

## 96D-Consumer Affairs

Consumer problems and protection; Truth in advertising; Commercial psychology; Product maintenance and reliability problems; Home appliances safety; Product comparison studies; Flammability studies; Motor vehicle recalls.

## 96E-Minority Enterprises

Minority owned and operated businesses; Business training of minority groups; Franchising; Equal opportunities in business.

## 96F-Banking & Finance

Investments; Credit; Banks and trust companies; Mortgage finance; Savings and loan associations; Security and commodity brokerage; Balance of payments; Gold and silver movement; Cash flow; Regulations; International finance.

*For government financial operations, use 43A, 70F, 91G, and/or 91H.*

## 96G-Foreign Industry Economic Development

Private and governmental industrial and economic development in foreign countries including industrialized and developing countries; International technology transfer;

*For foreign market surveys and international trade, use 96C.*

## 96H-Foreign Business & Economics

Foreign and developing countries; Businesses, economic conditions and socioeconomics.

*For foreign market surveys and international trade, use 96C.*

*For social concerns related to economics, see also 92C.*

## 97-ENERGY

### 970-General

Includes energy source development.

### 97A-Reserves

Natural reserves; Fuel stockpiles; Mineral and fossil fuel deposits including coal, uranium, petroleum, natural gas, geothermal, peat, and oil shale; Water power potential; Site studies of wind power potential and solar radiation availability.

*For individual mine studies, use 48A.*

### 97B-Energy Use, Supply, & Demand

Electric power and fuel consumption and requirements; Supply and demand; Heat use, supply, and demand.

### 97E-Electric Power Transmission

Electric power distribution; Electric transmission lines and substations; Electric power pools; Wireless energy transmission.

### 97F-Fuel Conversion Processes

Methods to convert a fuel to a different chemical form including coal gasification and liquefaction; Upgrading fuels by chemical synthesis.

*For petroleum refining, oil shale retorting and refining, use 97K and 99B;*

*For environmental studies, use 97R.*

### 97G-Policies, Regulations & Studies

Energy conservation; Licensing; Legislation; Government policies and regulatory controls; Energy goals; Research needs; Energy management, economics, and financing; Depletion allowances and leasing policies; Rates and energy models; Energy shortages; International issues.

### 97I-Electric Power Production

Design and operation of electric power plants; Commercial, industrial, and residential electric power production; Site surveys; Large-scale nuclear, hydro, solar, geothermal, and fossil fuel electric power plants; Power plant boilers.

*Note: usually restricted to large-scale electric power production.*

*For small-scale electric power production, use 97N, 97O, or 97P.*

*For pollution control and environmental impact, use 68 and 97R.*

*For some nuclear power plant studies, use 77 and 97Q. 97Q should be those that are most pertinent to the use of nuclear technology for energy production.*

### 97J-Heating & Cooling Systems

Design and operation of space heating and cooling systems and equipment; Furnace and boiler studies when related to energy conservation and energy use; Cooling towers; MIUS technology; Total energy systems.

*See also 97N.*



## 97K-Fuels

Production, performance, properties, storage, prices, and transportation of all types of solid, liquid, and gaseous fuels; Chemical composition of fuels; Fuel compatibility; Hydrogen production; Refuse derived fuels; Fuel desulfurization; Oil shale retorting; Petroleum refining; Fuel additives; Growing plants for fuels; Bioconversion and biomass plantations.

*See also 48D and 97N.*

*For fuel tanks, use 81C.*

*For nuclear fuels, use 77I.*

*For fuel conversion, use 97F.*

*For rocket fuels, use 81H.*

*For supply and demand, use 97B.*

*For oil and gas drilling and recovery, coal mining and other energy related mining studies, use 48A.*

## 97L-Engine Studies (Energy Related)

Operation and design of engines when related to energy conservation and energy use. Covers turbine, rotary, and reciprocating engines.

*See also 81.*

## 97M-Batteries & Components

Electrochemical batteries of all types including alkaline cells, dry cells, metal-air batteries, primary cells, reserve batteries, storage batteries, thermal batteries, wet cells; Battery containers, depolarizers, electrodes, electrolytes, separators, and other components and materials; Battery chargers and testers; Battery electrochemistry.

*For thermoelectric and thermionic batteries, use 97O.*

## 97N-Solar Energy

Solar collectors, concentrators, and absorbers; Solar cells; Solar cookers, dryers, furnaces, generators; Solar heat engines; Solar heating and cooling systems; Solar power plants; Solar stills; Solar water heaters; Solar heat storage systems; Solar water pumps; Solar sea power plants; Orbital solar power plants; Optical coatings and filters for solar devices; Solar energy policies, use, supply, trends, and economics.

## 97O-Miscellaneous Energy Conversion & Storage

Fuel cells; Magnetohydrodynamics; Experimental electric generators; Turbogenerators; Heat storage; Compressed air energy storage; Mechanical conversion; Thermoelectric and thermionic conversion; Photovoltaic conversion (excludes solar cells); Wind power; Tidal power; Nuclear fusion power plants.

*For commercial, industrial, and residential use of energy conversion and storage devices, use 97I or 97J.*

## 97P-Geothermal Energy

Geothermal exploration and prospecting methods and equipment; Geothermal resources; Geothermal energy conversion; Geology applied to geothermal systems; Drilling; Reservoirs; Extraction; Site selection; Geothermal power plants; Corrosion studies; Materials used in geothermal systems.

## 97Q-Selected Studies In Nuclear Technology

Reports assigned to this subcategory are selected for their broad interest to users in the nuclear energy field.

*For other nuclear energy subcategories, use 77.*

## 97R-Environmental Studies

Air, noise, water, and solid waste pollution and pollution control from energy resource development, fuel production, energy production, and energy use; Environmental impacts of energy production and use.

*See also 68.*

# 98-AGRICULTURE & FOOD

## 980-General

### 98A-Agricultural Chemistry

The application of chemistry and chemical analysis to agriculture; Fertilizer production; Soil chemistry; Chemistry of feeding stuffs; Crop chemistry; Biochemical studies.

*For food chemistry, use 98H.*

### 98B-Agricultural Economics

Economics conditions, markets, subsidies, and policies affecting agriculture; Farm management and finance; Land and labor economics; Prices and price control.

*See also 96C.*

### 98C-Agricultural Equipment, Facilities, & Operations

Agricultural engineering; Agricultural machinery and tools; Seed preservation; Planting, fertilizing, mulching, weeding, and harvesting; Pest and disease control techniques and equipment; Crop protection; Crop drying and storage; Farm water supplies; Irrigation systems; Farm safety; Farm construction and operation.

*For pest control, see also 57P.*

*For food processing, use 98H.*

### 98D-Agronomy, Horticulture, & Plant Pathology

Field crop production; Cultivation of orchards, gardens and nurseries; Plant biology; Plant breeding, propagation, and hybridizing; Hydroponics.

*See also 57C.*

## 98E-Animal Husbandry & Veterinary Medicine

Production and care of domestic and wild animals; Breeding, feeding, management, rearing, testing, and training; Pets; Animal pathology; Toxic effects on domestic animals; Animal quarantine; Disease resistance, control and treatment; Breeding, care, and utilization of laboratory animals.

*See also 57Z.*

## 98F-Fisheries & Aquaculture

Fishing, fishing equipment, and shipboard processing of fisheries products; Cultivation of fishes, shellfish, and algae in fresh or salt water for commercial or recreational use; Use of fish ladders and weirs; Sport fishing.

*See also 47D, 48B, and 57Z.*

*For fish processing, use 98H.*

## 98G-Agriculture Resource Surveys

Surveys to scan crop yields, soil moisture content, crop diseases, and forest diseases. Includes fishery surveys; Satellite and aerial surveys.

## 98H-Food Technology

Pasteurizing, curing, canning, dehydrating, freezing, irradiation, freeze drying, etc., of foods and other agricultural products; Sanitation and fumigation of products; Food additives and preservatives; Analysis and inspection of products; Storage, packaging, and display of products; Kitchen and cooking equipment.

*For biochemical studies of foods, see also 57B.*

# 99-CHEMISTRY

## 990-General

### 99A-Analytical Chemistry

Techniques and instrumentation for the separation and analysis of individual compounds or specific groups or compounds, both inorganic and organic. Includes qualitative, quantitative, volumetric, gravimetric, optical, spectroscopic; electrochemical, ion exchange, chromatographic analysis; Test methods; Forensic chemistry; Data interpretation; Routine analysis or experimental results.

### 99B-Industrial Chemistry & Chemical Process Engineering

Techniques, processes, unit operations, and plant equipment that apply to chemical manufacturing, processing, transportation, and storage; Petroleum refining; Desalination technology; Pollution control equipment; Process control technology; Process engineering; Chemical reactors.

*For coal gasification and liquefaction processes, see also 97F and 97K.*

*For specific environmental pollution control, see also 68.*

*For water purification, see also 50B and 68D.*

## 99C-Polymer Chemistry

Synthesis, properties, reactions and theories of polymers and copolymers. Includes all types of polymerization, curing, cross-linking, reaction kinetics, etc.

*For mechanical properties of polymers, use 71O and 71H.*

## 99D-Basic & Synthetic Chemistry

Synthesis, properties, and reactions of inorganic and organic compounds; Studies of individual or specific groups of chemical elements; Molecular structure; Stereochemistry.

*For chemical reaction mechanisms between atoms, ions, or molecules, see also 99F.*

*For spectrum analysis of compounds, use 99A and 99F.*

## 99E-Photochemistry & Radiation Chemistry

Studies involving the interrelationships of electromagnetic or particle radiation and chemical reactions; Studies of radioactive elements and their reactions; Radiochemistry; Photochemical reactions.

*See also 55A and 68A.*

## 99F-Physical & Theoretical Chemistry

Physical chemistry; Thermodynamics; Thermochemistry; Colloids and gels; Surface chemistry; Catalysis and catalysts; Electrochemistry; Solutions; Chemical equilibria; Membranes; Reaction kinetics; Quantum mechanics; The mathematical determination of atomic or molecular orbitals, energy levels, or properties; The application of mathematics to chemical systems and electronic spectra, excluding routine analysis or experimental results; Molecular spectra interpretation; Chemical reaction mechanisms in the gas, liquid, or solid phase between atoms, ions, or molecules; Atomic and molecular energy studies; Phase studies of nonmetallic systems; Isotherms; Crystallography.

*For advanced materials, use 71Gen or the field of application.*

*For solid state physics, use 46D.*

*For thermodynamics, see also 46Gen.*

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